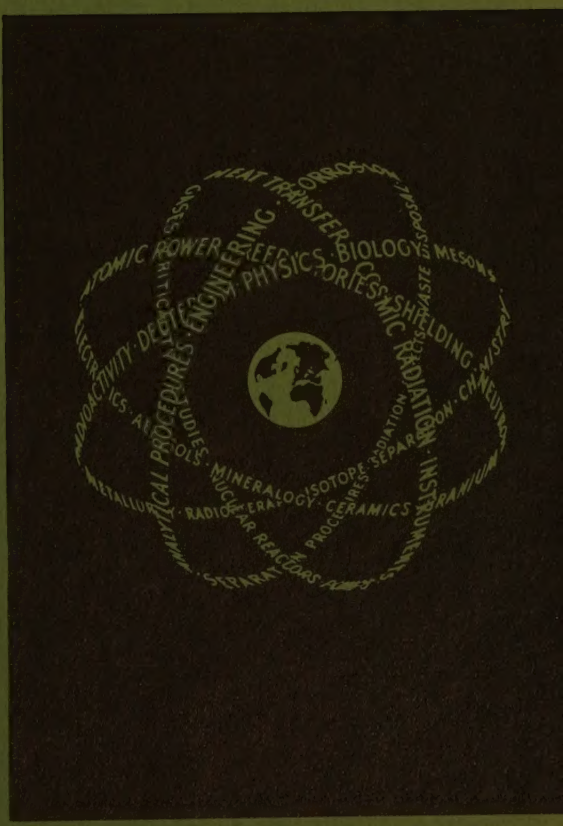
NUCLEAR SCIENCE ABSTRACTS



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NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service

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NSA covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.

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Abstracts included in *NSA* are arranged or grouped into a number of broad subject categories as illustrated by the table of contents. Since a subject index is now included in each issue, the categories have been reduced in number and made less specific than in previous volumes of *NSA*.

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The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Vols. 1 through 4 (July 1948–1950) is included in the bound Vol. 4 which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($6.00). A subject and author index covering Vols. 5 through 10 (1951–1956) is also available from the Superintendent of Documents ($5.25).

A cumulated report number index to *NSA* through Vol. 11 (1957) and to its predecessor, *Abstracts of Declassified Documents*, has been issued separately as report TID-4000, 3rd. Ed., *Availability List of USAEC Reports*. This report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. ($3.00).

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget February 3, 1959.

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 6A March 31, 1959

GENERAL

3468 AECU-3908

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

ANNUAL PROGRESS REPORT [COVERING] RESEARCHES DURING THE PERIOD JUNE 1, 1957 TO MAY 31, 1958. Report No. 53. 206p. Contracts Nonr-1841(16); AT(30-1)-2098; AF49(638)-181 and AT(30-1)-905. $31.80(ph OTS); $9.30(mf OTS).

Studies involving CCl_4, dibromoacetic acid, and p-dinitrobenzene have clearly demonstrated the effect on the halfwave potential of certain ions in the electrical double layer. The Pd–Pd black electrode is being compared with a standard hydrogen electrode in a variety of solutions. A study was initiated to explore possible analytical applications of ion-exchange membranes. Studies in gas chromatography were largely confined to the use of different liquids supported on inert solids. The extended study of thermometric acid-base titrations in acetonitrile was concluded. The photometric titration curves of a number of compounds, nitroanilines, show anomalous curvature. A systematic study of multiple-factor interference effects in flame photometry was undertaken. A study of molten salt systems as solvents for analytical operations is presented. The behavior of silicon carbide electrodes was investigated for two cases where they might possess advantages over Pt electrodes. The effects of diffusion and flow through charged cation-exchange membranes are reported. The distribution of HCl between a cation exchange and dilute aqueous solutions is presented. Potassium chloride uptake measurements are reported for anion-exchange resins. The determination of cation-exchange phase properties from freezing point measurements is reported. The thermodynamic acid dissociation constants K_{th} of $HClO_4$, HCl, HNO_3, HBr, and $HGaCl_4$ in water-saturated bis(2-chloroethyl) ether, are reported. A study is presented designed to establish equations by which experimental solvent-extraction data may be related to the average degree of polymerization, the average number of H^+ or OH^- associated with the metal species, and the average charge of the metal species in the two phases. The solvent extraction of In halides in bis(2-chloroethyl) ether is reported. The solubility and solvent distribution of AsI_3 between 2 to 7 M HI and the solvents C_6H_6, $CHCl_3$, and CCl_4 was measured. The determination is presented of the structural implications for cation exchange equilibria of ionic charge, radius, and the ion-surface composition of several anion-substitution complexes of hexammino-cobaltate(III) in displacing the La^{3+} from the cation resin Dowex 50. Three binary equilibrium systems with Dowex-2 are reported: ClO_4^-, Cl^-, and SCN^-. An investigation of K^{38} isomerism is reported. The attempted reaction $Cl^{35}(\alpha,n)K^{38}$ by α-particle bombardment of $CHCl_3$ vapor is presented. The determination of Na and K in rocks by activation analysis is reported. The gamma-ray spectroscopy of fission Ru isotopes and their daughters is presented. The decay properties of neutron-rich Pd and Ag are reported. The decay schemes of fission product isotopes of Cd with $A \geq 117$ are reported. The methanalysis of triphenylmethyl chloride is presented. The hydrolysis of alkyl and acyl halides in light and heavy water is reported. The decomposition of sulfonium salts in light and heavy water is discussed. The mechanism of oxidation of alcohols by bromine is given. The mechanism of decomposition of benzyl peroxide in cyclohexane solution is reported. As part of the program for the study of the fundamental particles, the cosmic ray group is now obtaining final results from data obtained at the Brookhaven Cosmotron with the large multiplate cloud chamber. Some of the results have yielded the lifetimes of the Λ^0 hyperon and the Θ_1^0, and Θ_2^0 components of the K^0 meson; the $\Theta_1^0-\Theta_2^0$ mass difference; a check of particle mixture theory; and an indication as to the spin of the Θ_1^0 particle. The sign of the asymmetry parameter in the parity nonconserving decay $\Lambda^0 \rightarrow p + \pi^-$ was determined. High energy accelerator physics group experiments of note have been the measurement of x-ray scattering from protons; a number of significant experiments involving mesons and the strange particles; and the development of a novel Cherénkov counter. Investigation was completed of the asymmetry of the μ^+-meson decay process and has contributed to the confirmation of the two-component neutrino theory. In the area of precision nuclear spectroscopy, detailed studies were carried out on isotopes of V, Cr, Sc, Ca, Ag, Cu, Fe, Ni, and K, among others. Investigations were completed on the complex level schemes of the Fe and Ni isotopes and the angular distribution of the protons from the deuteron bombardment of K. Research during the year with the Rockefeller generator consisted mainly of an investigation of the helicity of positrons from Al^{25}, carried out as part of a program to investigate the consequences of parity nonconservation in beta decay. The time-of-flight measurements of photoneutron spectra at the linear accelerator proved to be of unusual interest. Applied radioactivity studies were continued on the long-

term effects of internally deposited radioactive materials in human beings. Cyclotron research was centered on problems of nuclear structure and the mechanism of various types of nuclear reactions. A variety of alpha induced reactions was studied. Studies were continued on the elastic scattering of protons, deuterons, and alpha particles. Progress is reported in the field of nuclear reactions and the optical model of the nucleus-nuclear scattering. Recently evaluated forces between nucleons were employed to explain the scattering and absorption of neutrons and protons of high energy by nuclei. At lower energies a new unified formulation of the theory of these processes was made. In the general area of field theory a very important theorem was developed, which relates the low-energy component of the radiation spectrum and the scattering phase shifts. (For preceding period see AECU-3580.) (W.L.H.-W.D.M.)

3469 AECU-3931
Brookhaven National Lab., Upton, N. Y.
A STUDY OF PROPOSED USE OF GROUND WATER AT THE BROOKHAVEN NATIONAL LABORATORY AND ITS EFFECT UPON THE WATER TABLE. N. A. Christensen. [1957]. 74p. $12.30(ph OTS); $4.50(mf OTS).

An investigation was made of ground water conditions at the Brookhaven National Laboratory. The operation of the 30-Bev alternating gradient synchrotron will not tolerate even very small foundation movements. The use of ground water for machine cooling is highly economical. The survey was made to determine how much ground water may be drawn and recharged without excessive disturbance of critical foundations or the creation of undesirable changes in ground water temperatures. A generalized picture of the geology and ground water hydrology of the area was drawn from United States Geological Survey data. An electrical analog was developed to simulate the ground water flow patterns of the area. The percolation from precipitation as well as boundary and well flows were represented by electric currents in the analog. The solutions are presented as water table contour maps which may be used as a basis for other studies. As a result of the investigation it was possible to predict what changes in the water table might be expected for several specific use patterns of the ground water. It was concluded that the use of ground water for equipment cooling in future expansions is likely to be feasible as well as highly economical. (C.H.)

3470 TID-7557
Atomic Energy Commission, Washington, D. C.
FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 141p. $1.50(OTS).

Separate abstracts have been prepared on 11 sections of this report. (C.H.)

3471 TID-7557(p.1-4)
Division of Reactor Development, AEC.
DEVELOPMENT OF NUCLEAR POWER IN THE UNITED STATES. W. Kenneth Davis. p.1-4 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 4p.

The objectives, scope, and schedule of the program for the development of economic nuclear power in the United States are reviewed. The mutual advantages are discussed of contributions of scientists and engineers from abroad in the development, design, and construction of nuclear power plants. (C.H.)

3472 TID-7557(p.5-15)
Argonne National Lab., Lemont, Ill.
A REVIEW OF BOILING WATER REACTOR PERFORMANCE. J. M. Harrer. p.5-15 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 11p.

The boiling water reactor offers a low-investment means of producing electrical power from atomic fission. Design features of the Experimental Boiling Water Reactor are summarized. Operating experience is reviewed which makes the natural-circulation boiling system attractive. Advances in the associated engineering and fuel technology insure that a physical facility similar to the Experimental Boiling Water Reactor will not become absolute for many years. (C.H.)

3473 TID-7557(p.16-20)
Division of Licensing and Regulation, AEC.
CONSIDERATIONS IN THE CHOICE OF SITES FOR REACTORS. Clifford K. Beck. p.16-20 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 5p.

Evaluation of sites for reactors must begin with evaluation of the reactors for which the sites are sought. Factors to be considered are summarized. (C.H.)

3474 TID-7557(p.21-34)
Argonne National Lab., Lemont, Ill.
MANUFACTURE AND EXPOSURE HISTORY OF BOILING WATER REACTOR FUELS. James F. Schumar. p.21-34 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 14p.

The manufacture of fuel elements for the Experimental Boiling Water Reactor and Borax IV reactor is described. The exposure history for each is given, and the effects of irradiation are described and illustrated photographically. (C.H.)

3475 TID-7557(p.35-50)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FUEL RECYCLING IN POWER REACTORS.
R. Berman, L. S. Mims, S. Siegel, and R. J. Beeley. p.35-50 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 16p.

Two fuel recycle concepts are discussed. The role of pyroreprocessing vs. aqueous reprocessing of the fuel is examined for each concept. In the uranium-plutonium cycle the general problems of reactivity and isotope buildup are examined as functions of the reactor design parameters. An investigation of a large organic-moderated reactor, operating on the plutonium recycle with natural-uranium feed, is described in some detail. The problems of designing a thorium—uranium recycle reactor are discussed for various neutron energy levels. (auth)

3476 TID-7557(p.51-64)
Division of Biology and Medicine, AEC.
THE CHALLENGE OF NUCLEAR ENERGY TO THE LIFE SCIENCES. H. D. Bruner. p.51-64 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 14p.

The biological hazards to man associated with the de-

velopment of nuclear energy are reviewed. It is pointed out that these hazards can be effectively dealt with by intelligent application of recognized scientific and engineering principles. The author believes it is possible to achieve and maintain control of radiation and radioactivity to such an extent that the ecological systems of the surfaces of the earth can remain undamaged. Applications of nuclear energy in biological research and therapy are reviewed. It is pointed out that at present the biomedical sciences are in a phase of reorientation. In the next few years there will likely be a deliberate emphasis on applications of nuclear energy in fundamental biological research. 39 references. (C.H.)

3477 TID-7557(p.65-74)
Office of Industrial Development, AEC.
GROWING INDUSTRIAL USES OF RADIOISOTOPES. Paul C. Aebersold. p.65-74 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 10p.

Radioisotope applications are well on the way to becoming the foremost peaceful use of our atomic technology. As tracers and in gauging, radioisotopes will have a significant effect on the world's industrial economy. Radioisotope-process-control techniques, coupled with electronic-data tabulation and automatic-control devices, will assist in the realization of the age of automation, with the consequent transfer of human hands and minds from routine to more productive and satisfying labor. As sources of high-level radiation, radioisotopes will increase the distribution of foodstuffs and the variety of industrial products, reducing want and increasing the world's standard of living. New industries will arise to supply and service devices using radioisotopes and to exploit new discoveries in radiation applications. Radioisotopes will contribute materially to the health, leisure, and welfare of all mankind. The United States, through many educational and technical assistance programs encompassed by its Atoms-for-Peace Program, will make every effort to bring about world-wide benefits from the atom. (auth)

3478 TID-7557(p.75-9)
Atomic Energy Commission, Washington, D. C.
THIRD-PARTY LIABILITY ASSOCIATED WITH NUCLEAR INSTALLATIONS. Edward Diamond. p.75-9 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 5p.

Any country, acting by itself and pending the consummation of regional or world-wide international arrangements, can make an effective and substantial contribution to the solution of the third-party liability problem as it affects both its domestic and foreign operators. It is not necessary for a government to delay remedial action until (1) representatives of its own country and of other countries have mutually agreed upon the exact mechanics and details of the solution and drafted them into a proposed international convention, and (2) the appropriate legislative bodies have ratified the proposed convention or treaty. To effectuate such a procedure may take a long time, and the nature of the problem is such that its solution will not wait. The enactment of the Price-Anderson Act illustrates that each country, acting by itself only, has the power to enact its own legislation by which operators, both domestic and foreign, can be afforded protection against the risk of third-party liability arising from nuclear incidents occurring within its territory. Eventually, of course, such legislation should supplement or be superseded by an international arrangement by which desirable uniformity may be achieved. (auth)

3479 TID-7557(p.80-95)
Los Alamos Scientific Lab., N. Mex.
LOW-LEVEL COUNTING FROM ARCHAEOLOGICAL ARTIFACTS TO NUCLEAR REACTORS. Ernest C. Anderson. p.80-95 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 16p.

The principles and techniques of low-level counting as developed for the studies of natural radiocarbon have found many other applications, including measurements of fall-out. The control of radioactive waste disposal from power reactors will rely heavily on these methods. This paper reviews the present state of low-level counting, discussing selected examples of problems, including liquid scintillation counting of the contemporary biosphere concentration of radiocarbon, the measurement of Sr^{90} from fall-out, and the study of gamma activity of the human body due to natural K^{40} and fission-product Cs^{137}. 45 references. (auth)

3480 TID-7557(p.96-116)
New York Operations Office. Health and Safety Lab., AEC.
THE APPLICATION OF SOLID-STATE AND OTHER NEW COMPONENTS IN CIRCUITS FOR NUCLEAR INSTRUMENTS. H. D. LeVine. p.96-116 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 21p.

The advantages of transistor components and the development of useful transistorized counting circuits are described. Some developmental low-background counting arrangements and their applications are illustrated. The possibility of modular circuit blocks and the utility of combining these into instruments are covered. 28 figures. (auth)

3481 TID-7557(p.117-39)
New York Operations Office. Health and Safety Lab., AEC.
RECENTLY DEVELOPED COMPONENTS FOR APPLICATION TO NUCLEAR ELECTRONIC EQUIPMENT. H. D. LeVine. p.117-39 [of] FIFTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 16-30, 1958. (U. S. Papers). 23p.

A description is given of some new components that can be used in the design of nuclear equipment. Specifically, the expanding transistor component field, the subminiature parts, and special-purpose vacuum and photoemissive tube types are described. The benefits of the new types of components and the greater reliability achieved are also stressed. Methods of constructing photoetched circuits in the laboratory are described, as well as the potential of small-lot production. 21 references. (C.H.)

3482
PROSPECTS FOR THE UTILIZATION OF NUCLEAR ENERGY IN THE ENERGY DEVELOPMENT OF RUMANIA. Alexandru Szmuk and Antoaneta Soci. Acad. rep. populare Romîne Inst. energet. Studii cercetări energet. 8, 163-81(1958). (In Rumanian)

General economic aspects of the use of nuclear

energy for the production of electricity are considered. The necessity for the utilization of nuclear energy to fill the energy needs on a world scale is considered. The principal economic indices of nuclear power plants are compared with those of power plants using conventional fuel. It is indicated that in 10 to 15 years these values will be lower than for classical power plants. A survey is made of the prospects for the use of atomic energy in Rumania, considering the actual state of the problem on the world plane and the specific technical and economic conditions existing in Rumania. A program is proposed for the creation of a nuclear power plant and of certain branches of the atomic industry. (tr-auth)

3483

INDUSTRIAL APPLICATION OF RADIOISOTOPES AND THEIR INDUSTRIAL IMPORTANCE. George Manov. Bull. Inform. Assoc. belge develop. pacifique energie atomique No. 16, 11-17(1958) Sept. (In French)

The article on the industrial application of radioisotopes is concluded with some examples of the use of radiation reflection and atom tracers. The application of radioisotopes to chemical analysis and control of chemical processes is discussed. The economic aspects of the utilization of radioactive isotopes are briefly surveyed. (J.S.R.)

3484

1957 FOURTH NATIONAL SYMPOSIUM ON VACUUM TECHNOLOGY TRANSACTIONS. Wilfrid G. Matheson, ed. New York, Pergamon Press, 1958. 183p.

Papers given at the Fourth National Symposium on Vacuum Technology Transactions are given. These papers contain information on the following areas: scientific basis of vacuum techniques; application of vacuum techniques to scientific and applied research; methods and techniques for obtaining high vacuum and ultra high vacuum; methods of measuring high vacuum and ultra high vacuum; vacuum deposited metal films; and industrial high-vacuum applications. (J.H.M.)

3485

COMPRESSION IN ROOTS TYPE BLOWERS. Ernst A. Winzenburger (Consolidated Electrodynamics Corp., Rochester, N. Y.). pp. 1-5 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Roots-type blowers, which have been used for about one hundred years to handle air and gases at moderate pressures and low vacua, have recently been introduced into the high-vacuum field to cover the micron to millimeter range. In this type of application, the Roots blower requires a backing device of some sort to compress the gas from the millimeter range to atmospheric pressure, because the compression ratio which can be economically obtained in the Roots blower alone is limited and dependent upon the pressure range within which it operates. The combination of a Roots blower with an oil sealed mechanical pump is of special interest for the production of moderately high vacua. When employed in this way, the pumping speed curve, which always applies to a particular combination only, depends not merely on the characteristics of the blower, but also very materially on the performance of the mechanical pump. For a given blower, the maximum pumping speed changes with the capacity ratio of blower to pump. A large variety of speed curves are thus possible. The question often arises as to how the pumping speed of a certain blower-pump combination changes when another backing pump is substituted. This problem was investigated experimentally and the results were used to evolve a method for predicting the speed curve of a new combination. The variation of the ratio of discharge to intake pressure of a blower and its dependence on the performance curve of the backing pump are discussed. (auth)

3486

OIL DIFFUSION PUMPS FOR VERY LOW ULTIMATE PRESSURES. H. G. Nöller, G. Reich, and W. Büchler (E. Leybold's Nachfolger, Cologne). pp. 6-12 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Detailed studies are reported on oil diffusion pumps. It is shown that by using pumps which are designed to make full allowance for the results of these studies, and with properly selected pump fluids, ultimate total pressures below 10^{-7} mm Hg can be attained and the high vacuum is relatively free of hydrocarbons. (auth)

3487

ROLE OF ADSORPTION IN PRODUCTION AND MEASUREMENT OF HIGH VACUUM. Chikara Hayashi (Japan Vacuum Engineering Co., Ltd.). pp. 13-26 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

The effect of adsorption on the production and measurement of high vacua is discussed. Information is included on the flow of gas and the behavior of oils in high-vacuum systems. It is shown that a high vacuum is not necessarily a clean space where a clean experiment might be done. Rarefied density of gas molecules in space does not mean rarefied density of the same molecules at a surface in the space. (J.H.M.)

3488

STRUCTURE DETERMINED PROPERTIES OF EVAPORATED BISMUTH FILMS. Carl E. Drumheller (Univ. of Illinois). pp. 27-33 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Infrared and electrical studies made on evaporated bismuth films suggest that the observed characteristics are largely determined by the film structure. The films were evaporated at 10^{-5} mm pressure onto cellulose nitrate substances. Electron microscope examination shows that up to about 2000 A thickness the films possess a single-layer polycrystalline structure. Thickness-resistance measurements and low frequency current noise studies indicate that the major contribution to the film resistance is from the grain boundaries. Temperature–resistance characteristics have been related to average crystallite size. The infrared studies indicate that there are two types of grain boundaries, namely, those which contribute to the conductivity and those which do not. This conclusion is also confirmed by electron diffraction effects. By taking into account the capacitance of the grain boundaries, it is possible to explain the infrared characteristics. Calculations from the measurements give an initial grain-boundary thickness of about 15 to 30 A. (auth)

3489

PREPARATION AND PROPERTIES OF CLEAN HIGH-AREA METAL AND ALLOY EVAPORATED FILMS FOR USE IN SURFACE STUDIES. S. J. Stephens (Bell Telephone Labs., Inc., Murray Hill, N. J.). pp. 34-7 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

The system gold–palladium has been used to study changes in surface properties as the composition of

the metal substrate is varied from 100% gold to 100% palladium. Gold forms homogeneous alloys with palladium over the entire concentration range, and the lattice constant of the alloy system changes almost linearly with concentration. Method of preparation of clean, high-area palladium and gold–palladium alloy films is described. The films were characterized by chemical analysis (in the case of the alloys), x-ray and electron diffraction, and surface area measurements. The surface studies in which these films have been used are discussed. (auth)

3490

RESISTANCE-TEMPERATURE CHARACTERISTICS OF EVAPORATED CHROMIUM FILMS. Dorothy M. Hoffman and Jacob Riseman (International Resistance Co., Philadelphia). pp. 42-6 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

The resistance-temperature characteristics of evaporated chromium films have been studied as a function of thickness. Resistivities from 25 to 1000 × 10^{-6} ohm-cm and thicknesses of 70 to 1700 A have been studied. (auth)

3491

THE EVAPORATION MODE OF CERTAIN VACUUM METAL DISTILLATION SOURCE CONFIGURATIONS, THROUGH COMBINED AUTORADIOGRAPHY AND DISTILLATION CAMERA EXPOSURES. L. E. Preuss and C. E. Alt (Edsel B. Ford Inst. of Medical Research, Detroit). pp. 47-72 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

A new method, which has been developed for the self-imaging of the spatial confines of the distillation geometry of vacuum evaporation sources, has been used in this work to map the regions of distillant emanation from a series of simple metal evaporation sources. Image formation is achieved by condensation of a radioactive metal distillant at the image plane of a simple vacuum distillation camera. The autoradiographic process with the gross apposition method is utilized to intensify the very tenuous condensed metal image. This permits a qualitative survey and quantitative assay to be made of the distillation rate from the various regions of the source. This report consists of a review of the technique, and some images of certain distillation geometries are presented by this method. The influence of surface tension effects, wetting, filament temperature, and system pressure on the distillation geometry has been studied by this system for very small charge masses. Preliminary investigations of source configuration by such self-image formation have clarified some gross aspects of the distillation mechanism. The technique opens a new and profitable avenue of study of the vacuum distillation mode. (auth)

3492

DESIGN CRITERIA FOR ACCELERATOR VACUUM SYSTEMS. Russell N. Edwards and John F. Lawyer (General Engineering Lab., Schenectady, N. Y.). pp. 73-82 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Some principles to be considered in designing vacuum systems for particle accelerators are reviewed. Information is included on: short-path gas scattering, multiple scattering, sporadic discharge, and electric breakdown in vacuums; pumping speed limitations; contamination of accelerator components; and sources of gas in accelerators. (J.H.M.)

3493

DISTRIBUTED DIFFERENTIAL PUMPING. R. C. Knechtli (RCA, Princeton, N. J.). pp. 83-7 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

In an experiment on plasma beams, it was found necessary to maintain a pressure ratio of the order of 10^5 : 1 between the region where the plasma was generated and the region where it was used. The plasma was to be transported from the high to the low pressure region by gas flow. The differential pumping system devised for this purpose consists of three constricting tubes communicating to separate pumping chambers through apertures distributed along and around the tube walls. This constitutes a distributed pumping system. By proper distribution of the apertures along the constricting tubes, the variation of gas flow velocity with distance can be controlled. The following conditions in particular can be realized simultaneously: constant gas flow velocity along the whole length of the differential pumping system; and exponential decrease of pressure with distance. By keeping the gas flow velocity constant, the transit time of particles carried by the gas flow from the high to the low pressure region is in first approximation minimized. When a plasma is transported by this gas flow, the ion transit time and the recombination loss can thus be minimized. Such a distributed differential pumping system has been realized. Experimental results have confirmed quantitatively the theory of distributed pumping presented in this paper. Typical operating conditions are a pressure of 0.1 mm Hg in the high pressure chamber, 8.10^{-7} mm in the "high vacuum" chamber, constrictions of 8 mm diam. between chambers, and three pumping chambers with diffusion pumps of an effective speed of approximately 100 l/sec each. (auth)

3494

THE STEAM JET EJECTOR: A VERSATILE PUMP FOR HIGH VACUUM. V. V. Fondrk (Elliott Co., Jeannette, Penna.). pp. 88-94 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Recent developments in steam jet ejectors have extended the range of this vacuum pump to absolute pressures well under ten microns. This makes available, at relatively low initial cost, pumps of large capacity—extending to 250,000 cfm or more. Performance characteristics are described. Cost of equipment in relation to capacities is charted. Installation, operating, and maintenance costs are discussed. A description of a typical installation on a consumable electrode vacuum melting furnace is given. Use of ejectors on stream degassing units presently operating in various steel mills and foundries in this country is covered. (auth)

3495

A LARGE METAL SYSTEM PERMITTING LOW BASE PRESSURES. J. Ralph Ullman (Univ. of California, Livermore). pp. 95-6 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

A large all-metal vacuum system consisting of an oil diffusion pump, a water-cooled baffle, and a liquid nitrogen trap all in series with, and pumping on, the vacuum chamber is described. By means of special techniques described herein, low base pressures of (3.0 or 4.0) × 10^{-10} mm Hg are attained. Resultant pressures for the complete vacuum system varied between 5 × 10^{-9} and 8 × 10^{-10} mm Hg for a period of 10 days. (auth)

3496

PRODUCTION OF VERY LOW PRESSURES WITH GETTER-ION PUMPS. G. Reich and H. G. Nöller (E. Leybold's Nachfolger, Cologne). pp. 97-9 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Investigations were made of getter-ion pumps, in which titanium is used as the getter metal, to determine their capacity for producing low pressures. It was shown that in clean conditions, such as after thorough heating and evacuation of the system with a diffusion pump, pressures of 1×10^{-9} mm Hg and below can be attained. Failure to carry out this pre-treatment, by means of which rare gases, hydrogen, and hydrogen-containing gases are removed, will lead to the formation of ordinary hydrocarbons which, even after a lengthy pumping time, determine the ultimate pressure. (J.H.M.)

3497

GAS COLLECTION AND ANALYSIS SYSTEM EMPLOYED IN VACUUM TUBE PROBLEMS. J. Morrison (Bell Telephone Lab., Inc., Murray Hill, N. J.). pp. 100-3 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Gas is collected in a system consisting of a small mercury diffusion pump, an automatic Toepler pump, and a calibrated capillary pipet. After measurement, the gas is brought to a small mass spectrometer through an appropriate capillary leak. The mass spectrometer is calibrated for quantitative analysis by analyzing synthetic mixtures of known gases. This system has been employed in studies of gases evolved by vacuum tubes and their component parts during pumping and subsequent life aging. Also tubes with thousands of hours of life aging have been opened in vacuo and then operated in the system in order to determine the quantity and composition of the gas evolved during life aging. (auth)

3498

A NEW SILICONE DIFFUSION PUMP FLUID. Arnold R. Huntress and A. Lee Smith (Dow Corning Corp., Midland, Mich.) and B. D. Power and N. T. M. Dennis (Edwards High Vacuum Ltd., Crawley, Eng.). pp. 104-11 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

A new single-component silicone fluid has been evaluated for use in diffusion pumps. This fluid combines the stability for which the silicones are noted with a high ultimate vacuum, equal or superior to that produced by the best organic pump fluids. It is shown that decomposition under operating conditions is low compared with organic fluids. Consequently, the fluid gives low ultimates in pumps of mediocre purifying ability. Because of its high boiler pressure, the fluid has a high forepressure tolerance and a high mass throughput. The new fluid is markedly superior to existing fluids in resistance to damage from nuclear radiation. (auth)

3499

A MAGNETIC AMPLIFIER CONTROL CIRCUIT FOR A THERMAL CONDUCTIVITY VACUUM GAUGE. Allen R. Hamilton (Consolidated Electrodynamics Corp., Rochester, N. Y.). pp. 112-14 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Information is presented on the operation of a magnetic amplifier, and its application to a vacuum gage is described. The magnetic amplifier, used in the dual function of constant temperature control and automatic voltage, makes possible a simple, stable, trouble-free vacuum gage with a much greater pressure range than was possible with the conventional Pirani type gage. (J.H.M.)

3500

A NEW TYPE OF VACUUM LEAK DETECTOR. F. L. Torney, Jr. (NRC Equipment Corp., Newton, Mass.). pp. 115-19 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

A new type of halogen leak detector, having a sensitivity which approaches that of a helium mass spectrometer, is described. This paper outlines in detail the reasons for selecting this new approach and the details of circuit design which accomplish this end. Operational characteristics of a halogen sensing element are discussed and their influence on circuit design is analyzed. A brief discussion of the advantages and disadvantages of this method is given, with particular emphasis on the electronic circuit design parameters which make these advantages possible. (auth)

3501

PERMEATION OF AIR THROUGH WALLS OF PLASTIC TUBING USED IN LOW PRESSURE SYSTEMS. James M. Kendall (U. S. Naval Ordnance Lab., White Oak, Silver Spring, Md.). pp. 120-4 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Information is presented on the permeation of air through the walls of plastic tubing used in supersonic wind tunnels. The supersonic wind tunnel, which is itself a low-pressure system, involves much work with accessory low-pressure systems, especially pressure measuring instrumentation, all of which make use of plastic tubing. Discussions are included on how a tunnel is used to measure the pressure distribution over the surface of a model held in the tunnel test section. Systems for measuring the permeation of air through the walls of tubes and for simulating supersonic wind tunnel pressure measurements are described. (J.H.M.)

3502

A SIMPLE MASS SPECTROMETER FOR THE IDENTIFICATION OF RESIDUAL GASES IN HIGH VACUUM SYSTEMS. George D. Perkins and Douglass E. Charpentier (Consolidated Electrodynamics Corp., Pasadena, Calif.). pp. 125-8 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

A structurally simple double focusing mass spectrometer has been designed as a versatile instrument for the identification of the residual gases in high vacuum systems. The unit is capable of measuring the total pressure of all gases in the system as well as the partial pressure of any gas with molecular weight as high as mass 80. The high sensitivity of the instrument makes it useful as a leak detector, and the mass range allows latitude in the choice of leak searching gases. (auth)

3503

SOME ASPECTS AND DEVELOPMENTS OF VACUUM DRYING AND IMPREGNATION. G. W. Oetjen (Leybold-Hockvakuum-Anlagen GmbH, Cologne). pp. 129-35 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

During the last two years the drying, degassing, and impregnation of paper-insulated electric parts has been intensively developed in two directions: when applying all auxiliary means, constantly rising charges (paper-weight) can be dried in relatively short and

thus economically reasonable times; and more exact knowledge on fundamental procedures enables more quantitative prognoses as to the processes to be chosen and allows a more exact control of the results than hitherto. Several examples show the possibility of supplying the required quantities of energy in vacuum procedures, in economically reasonable times, by a suitable choice of the heating methods. Apart from procedures already known we will consider an arrangement which simultaneously supplies heat and removes water vapors by means of circulated superheated water–steam, and in the light of the latest tests the reaction of extremely dried impregnating agents is treated. (auth)

3504

METALLIZING OF FLEXIBLE SUBSTRATES. Philip J. Clough (National Research Corp., Cambridge, Mass.). pp. 136-7 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

For metallizing sheet material, economy demands that the metallizing operation be performed on rolled stock. This can be carried out in either semi-continuous or truly continuous operation. Problems encountered in this include rapid reaction between the liquid metal being evaporated and the container used to support it, heat sensitivity of the substrate, and the necessity of uniformity of deposits over wide webs. Above 1200°C aluminum is an extremely active solvent. This paper discusses a technique which enables the use of carbon base crucibles and makes possible the evaporation of aluminum at high, steady rates for periods of hours. The conditions for minimum heat transfer to the substrate are considered, as are the geometric arrangements of the sources to assure uniformity. (auth)

3505

HIGH VACUUM TECHNIQUES FOR NUCLEAR PHYSICS. Max Auwaerter (Gerätebau-Anstalt, Balzers, Germany). pp. 143-7 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Examples are given to show the importance of high vacuum technique with respect to its application in nuclear physics and nuclear technique. In nuclear physics high vacuum elements are needed for mass-spectroscopy and also for accelerators. The choice between suitable pumping systems, i.e., the use of oil-diffusion pumps, mercury-diffusion pumps or ion getter pumps is discussed. Furthermore, a survey is given regarding suitable valves, measuring and high vacuum control gauges which are applicable as regulating devices. A servo-control mechanism for ion sources is described. The nuclear technique demands material such as uranium, zirconium, beryllium which is produced in high vacuum processes. Suitable apparatus of latest design such as arc-melting plants, sintering plants and induction melting plants are discussed. (auth)

3506

CONTINUOUS EVAPORATION OF REFRACTORY METALS BY ELECTRON BOMBARDMENT WITHOUT USING SUPPORT MATERIALS. Norman Milleron (Univ. of California, Livermore). pp. 148-9 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Molybdenum and titanium wires have been evaporated at rates of 0.050 g/min for several hours by continuous electron bombardment of the wires themselves. The wires are bombarded with electrons after being fed through a rapidly cooled copper tip. The cooled tip permits a stable, continuously evolving molten ball of metal to be held by surface tension on the parent wire. The rate of evaporation is determined by the continuous rate of feed of the wire, matched to the power delivered to the molten ball by the accelerated electrons. The wire is continuously pre-outgassed as fully as possible by I^2R heating to minimize the amount of gas released during evaporation. If an alternating electric potential is applied between the bombarding filament and the molten ball, a very large electron current may be drawn from the molten ball. (auth)

3507

THE REMOVAL OF GASEOUS IMPURITIES BY VACUUM ARC MELTING. Stanley J. Noesen (General Electric Research Lab., Schenectady, N. Y.). pp. 150-6 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

The pressure of the non-condensable gases in a consumable electrode arc was measured. This pressure was obtained by utilizing a hollow molybdenum arc melting electrode. A pressure of 3000 microns was measured in the arc zone of the melting crucible while a pressure of less than 1 micron existed in the furnace body directly above the melting crucible. Using fairly impure raw materials, the degree of purification obtainable in this equipment was also determined. In the molybdenum alloy melted, it was found that oxygen was reduced from 780 ppm to 4 ppm, nitrogen was reduced from 190 ppm to 6 ppm and hydrogen was reduced from 130 ppm to < 1 ppm. The mode of purification is discussed. Finally, some observations are made concerning the criteria for choosing a particular vacuum system to do a specific vacuum arc melting job. (auth)

3508

VACUUM STREAM-DEGASSING. K. C. Taylor (F. J. Stokes Corp., Philadelphia). pp. 157-60 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

An illustrated review of the background and current status in the iron and steel industries of this newly significant vacuum metallurgy technique. Included are brief discussions of the history of the process and its present state of useful development; material on the properties and applications of stream-degassed steel; analyses of operating procedures, and costs; and considerations on equipment design requirements. (auth)

3509

VACUUM HEAT-TREATING. Roger R. Giler (Westinghouse Electric Corp., Meadville, Penna.). pp. 161-7 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

Commerical vacuum heat-treating is still relatively new and the few basic principles involved are usually not fully understood by the users of the equipment. Some of these principles as related to their actual effects are discussed here. A review of the evolution of commercial vacuum furnaces and their problems is given, including some recently built cold retort furnaces in which the heating elements are located inside the vacuum chamber and the thermal insulation is provided only by metallic radiation shields. (auth)

3510

WHAT VACUUM MELTING PROCESS SHALL I USE? A. M. Aksoy (Crucible Steel Co., Syracuse, N. Y.). pp. 168-76 in "1957 Fourth National Symposium on Vacuum Technology Transactions."

The basic principles, advantages, and limitations of vacuum induction melting, vacuum arc remelting, and vacuum degassing processes are discussed. Vacuum induction melting is used for the production of high quality products relatively small in size and where composition control is essential. Vacuum arc remelting is most suitable for large forgings where sound centers are mandatory and for quality products of less critical nature. Vacuum degassing is primarily used to reduce hydrogen content of steel. In areas where the application of these processes overlap, the cast should be the deciding factor in the selection of the process to be used. (J.H.M.)

BIOLOGY AND MEDICINE

Refer also to abstracts 3649 and 3650.

3511 AD-158451

Wisconsin Alumni Research Foundation, Madison.
POSSIBLE CARCINOGENICITY OF IRRADIATED FOODS. Progress Report for January 15, 1957 to November 15, 1957. L. J. Teply and B. E. Kline. 10p. Contract DA-49-007-MD-583.

No significant differences in weight or tumor incidence were noted between control groups of rats and mice and groups fed irradiated foods. Data are tabulated from experiments extending over an 18-month period. (C.H.)

3512 AD-159579

Michigan. Univ., Ann Arbor. Engineering Research Inst.
HIGH RADIOPASTEURIZATION OF FOODS. Report No. 6 (Final) [for] September 21, 1956—September 20, 1957. Lloyd E. Brownell. 44p. Contract DA-19-129-QM-756.

An investigation was made of methods for the sterilization of foods by irradiation to permit long-term storage. Research led to the discovery of radiation-resistant microörganisms. Irradiation doses of about 1 megarep were found to destroy all the microörganisms that cause food poisoning except some of the more resistant spore formers. This dose also destroys most vegetative food spoilage microörganisms, yeast, and mold. Considerable difference in the response of various foods to irradiation was observed. Certain food items such as cooked beef and cheese were very unsatisfactory when irradiated and tested by themselves but produced satisfactory food products when irradiated after combination with other foods. The shelf-life of some foods was increased by refrigeration after radiation treatment. Procedures and results are reported for a number of fruits, vegetables, baked products, and precooked products, combining a number of ingredients, such as beef stew and shrimp creole. Recipes are included for the precooked products. (C.H.)

3513 AD-161956

Baylor Univ., Houston, Tex. Coll. of Medicine and Jefferson Davis Hospital, Houston, Tex.
A STUDY OF THE EFFECTS OF TOTAL AND PARTIAL BODY RADIATION ON IRON METABOLISM AND HEMATOPOIESIS. Progress Report for Period March 1, 1958—May 31, 1958. V. P. Collins, C. T. Teng, W. R. Karn, and W. D. West. 14p. Contract DA-49-007-MD-428.

One patient, who had been treated previously with chemotherapy for chronic lymphatic leukemia, was given fractionated doses of x radiation. Hematopoietic response to both forms of treatment is being observed. Another patient with disseminated cancer and microcytic anemia who received auto-transfusion with irradiated blood is being followed for hematologic response. (C.H.)

3514 AD-200487

New York. State Univ. Veterinary Coll., Ithaca. Lab. of Radiation Biology.
DEPOSITION AND REMOVAL OF RADIOISOTOPES FROM THE BODY. Quarterly Progress Report for April 1, 1958—June 30, 1958. C. L. Comar and R. H. Wasserman. 17p. Contract DA-49-007-MD-897.

In the living animal containing cesium—137 it has been shown there is a metabolic dissociation of the radioactive daughter barium—137m. This means that some tissues such as bone and plasma will have a significantly increased level of barium—137m as compared with that expected from the usual radioassay measurements of cesium—137. The technique of peritoneal lavage was used to study metabolic processes involved in the removal of alkaline earths from bone. Methods have been established for studying the factors that govern the movement of alkaline earths from the digestive tract to the body. Special attention is being given to the ability of certain sugars to enhance gastrointestinal absorption. Lactose and xylose increased strontium absorption more than that of calcium. The enhancing effect of lactose occurred mainly in the small intestine, and there is a suggestion that an active transport process is involved. Lactose also tended to decrease the emptying rate of the stomach. (auth)

3515 AD-200734

Syracuse Univ., N. Y. Biological and Food Research Center.
LONG-TERM FEEDING OF IRRADIATED CHICKEN STEW AND CABBAGE TO RATS. Report No. 2 [for] Nov. 1, 1957—May 1, 1958. A. W. Phillips. 34p. Contract DA-49-007-MD-783.

No significant differences were observed in weight gains or feed efficiencies of rats observed for 43 weeks while maintained on a diet of irradiated chicken stew and cabbage. The irradiated diet did not significantly affect the reproductive performance or the blood picture of the rats. No effect was found on the intestinal mucosal levels of hexokinase, alkaline phosphatase, sucrase, or glutamic-oxalacetic transaminase. (C.H.)

3516 AECU-3898

Utah. Univ., Salt Lake City.
THE FLUORESCENCE OF CHLOROPLASTS AND CHLORELLA IN RELATION TO THEIR PHOTOCHEMICAL ACTIVITY. Technical Report No. 23. Berger C. Mayne, John D. Spikes, and Rufus Lumry. Aug. 1, 1958. 84p. Project No. 4. Contract AT(11-1)-82. $13.80 (ph OTS); $4.80(mf OTS).

A study was made of fluorescence in Chlorella and in isolated chloroplasts. Methods are described for photometric measurements of fluorescence and potentiometric measurements of the Hill reaction rate. The effects of various exposure conditions, photosynthesis inhibitors, and ionizing radiations on fluorescence were studied. Data are presented graphically. (See also AECU-3378.) (C.H.)

3517 AMRL-57

Army Medical Research Lab., Fort Knox, Ky.
INVESTIGATIONS INTO THE FIRST EFFECTS OF X-RAYS ON LIVING PROTOPLASM AS STUDIED WITH MODERN FLUOROCHROMES. S. P. Strugger, A. T. Krebs, and Z. S. Gierlach. June 1, 1951. 33p. Project No. 6-64-12-06-(42).

The effects of x radiation on plant cells immediately after and during irradiation were studied with the aid of fluorescence microscopic methods and vital straining. A photographic record was made of the radioinduced changes. It is concluded that the method can be used for the detection of both early and delayed effects of radiation. 24 figures. 23 references. (C.H.)

3518 HW-56928
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1958. J. W. Healy, ed. July 28, 1958. 41p. Contract W-31-109-Eng-52. $1.25(OTS).

A test was made to determine the effect of changing concentrations of reactor effluent in the Columbia River on young Chinook salmon. Data are tabulated. Progress is reported in the following studies: the effects of chronic ingestion of low-level iodine-131 in sheep and swine; tracer studies on strontium metabolism in swine and rats; the effects of various treatments on the absorption and tissue distribution of plutonium; the effects of dietary calcium levels on strontium-90 bone deposition in rats; and the absorption and metabolism of fission products in rats. The fate and toxicity of inhaled radioactive materials were studied in mice. Data are included for particles containing plutonium-239, ruthenium-106, iodine-131, and strontium-90. Increased genetic effects were observed from phosphorus-32 metabolized by yeast cells when compared with the effects from phosphorus-32 in the medium surrounding the cells. Data are included from studies on the effects of soil conditions on the uptake of strontium-90 by plants. Results are reported from routine radiobiological studies and environs monitoring activities. A study was made of the formation of radioisotopes in reactor effluent water, and an analysis was made of reactor film material removed from two process tubes by purging with a chemical cleaner. Fluorescein dye was used in studies of ground water flow. Laboratory investigations were conducted to obtain data for waste disposal studies. (For preceding period see HW-55586.) (C.H.)

3519 NP-7018
Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 29. Oct. 15, 1958. 89p. Contracts AF41(657)-25 and AF41(657)-252.

An attempt was made to correlate the radioprotective activity of certain thiourea derivatives with their ability to inhibit sulfhydryl enzyme systems of animal tissues. Data are tabulated. Results suggest that reactions between radioprotective compounds and biological sulfhydryl groups are important in protecting animals against lethal doses of ionizing radiation. Lethal doses of x radiation failed to inhibit the cytochrome C and glutamine synthetase activity of several rat tissues. Studies were continued on the effect of x irradiation on the synthesis of citric acid by rat tissues in vitro. Results provide additional information concerning the effects of x radiation on the intermediary carbohydrate metabolism of animal tissues. Mortality data are included on mice 18 to 26 months after initial exposure to gamma and fast neutron irradiation. Preliminary measurements are reported on light reflectance from mouse fur following chronic exposure to low levels of fast neutrons. A reflectometer adapted for making the measurements is described and illustrated with a schematic sketch. Fifty-one chemical compounds were tested for their effects on survival time, weight loss, and mortality in mice exposed to doses of 800-r x radiation. Data are tabulated and presented graphically. Procedures are described for the synthesis of a number of 2-aminoethylisothiuronium analogs. The compounds will be tested as protective or therapeutic agents against radiation injury in experimental animals. (For preceding period see NP-6899.) (C.H.)

3520 NP-7148
Brussels. Centre D'Étude de l'Énergie Nucléaire.
TRITIUM IN BIOLOGY. W. Verly. Jan. 1958. 47p.

Applications of tritium as a tracer in biological studies are reviewed. The natural occurrence of tritium, methods of detection, and toxic effects are discussed. Procedures are included for the preparation of a number of tritiated organic compounds for use in biological tracer studies. 36 references. (C.H.)

3521 NYO-7852
[New York Univ., New York].
INVESTIGATION OF FACTORS WHICH MAY MODIFY NEOPLASTIC CHANGES INDUCED BY IRRADIATION. Final Report [for] November 1, 1953–May 31, 1956. William E. Smith, Milton Friedman, and Anna M. Slicher. 23p. Contract AT(30-1)-1654. $4.80(ph OTS); $2.70(mf OTS).

Mice were exposed to graded doses of x radiation and observed throughout their lives for neoplastic changes induced by irradiation. The frequency of tumors in the irradiated mice is compared with data on untreated control mice. The effects of streptococcus infection, injections of uridylic and cytidylic acids, and injections of desoxyribonucleic acid on tumorigenesis were also investigated. In C57 black mice, a correlation was observed between degree of graying of the hair and radiation dose. Data are tabulated. (C.H.)

3522 UCRL-8525
California. Univ., Berkeley. Radiation Lab.
FREE RADICALS IN PHOTOSYNTHETIC SYSTEMS. Melvin Calvin. Oct. 8, 1958. 23p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The method of detecting unpaired electrons in liquid and solid systems by electron spin resonance is discussed. The significance of the hyperfine structure in electron spin resonance is discussed, and the possible use of these structural features of the electron spin resonance spectrum to elucidate the nature of the photoproduced unpaired electrons in photosynthesizing systems is introduced. (auth)

3523 USNRDL-TR-284
Naval Radiological Defense Lab., San Francisco.
CONCERNING POLYDIPSIA AND POLYURIA BY THE X-IRRADIATED RAT. R. E. Kay and C. Entenman. Oct. 16, 1958. 17p.

The results of partial-body x irradiation experiments established the abdomen as the radiosensitive area involved in post-irradiation polydipsia and polyuria. However, the responses do not appear to be due to the action of x rays on any one organ in this region, since x irradiation of individual exteriorized organs was ineffective. On the other hand, shielding of the exteriorized kidneys or liver prevented post-irradiation polyuria and polydipsia. Removal of the adrenals or spleen prior to x irradiation did not prevent polydipsia or polyuria, whereas removal of the pancreas or the pituitary gland

did. Anoxia during the time of x irradiation did not prevent polyuria or polydipsia, but when isotonic sugar solutions were given as the drinking fluid, polyuria and polydipsia did not occur. (auth)

3524 AEC-tr-3498

EFFECT OF ORTHO- AND PYROPHOSPHATE ON THE DECOMPOSITION PROCESSES OF DESOXYRIBONUCLEIC ACID IN ANIMAL TISSUES. (Deistviye Orto- i Pirofosfata na Protsessy Raspada Dezoksiribo-Nukleinovoi Kisloty v Zhivotnykh Tkaniakh). G. A. Kritskii. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 119, 336-8(1958). 5p.

Data are presented on the reactions of pyrophosphorolysis and phosphorolysis in the decomposition of desoxyribonucleic acid in animal tissues. It is suggested that the induction of reversible reactions of pyrophosphorolysis in the exchange of desoxyribonucleic acid may be one of the causes of disturbances in the exchange of desoxyribonucleic acid induced by ionizing radiation. (C.H.)

3525 AEC-tr-3528

MOST FAVORABLE CONDITIONS IN OBTAINING RADIOACTIVE TOBACCO MOSAIC VIRUS. (Optimale Bedingungen für die Gewinnung von Radioaktiven Tabakmosaikvirus). G. Wüstinger, E. Broda, and H. Schönfellinger. Translated by Lydia Venters (Argonne National Lab.) from Monatsh. Chem. 86, 131-6(1955). 7p.

Leaves infected with tobacco mosaic virus were exposed to radioactive carbon dioxide. A virus of high specific activity resulted. A significant part of the activity was in the nucleic acid part. Experiments carried out in the light and in the dark indicated that the assimilation of radiocarbon in the virus is not necessarily connected with photosynthesis in the host. (C.H.)

3526 CEA-tr-A441

EFFETS SUR L'ORGANISME HUMAIN DES RAYONNEMENTS RADIOACTIFS RICHES EN ÉNERGIE. (Effects on the Human Organism of High Energy Radioactive Radiations.) A. Catsch. Translated by A. Combaras from Atomwirtschaft 3, 73-6(1957). 13p.

A survey on the effect of high-energy radiation on the human body is presented. The units used are defined. The subjects discussed are acute and delayed lesions caused by radiation, radiation effects on heredity, influence of the nature of the radiations, maximum permissible dose, and incorporation of radioactive products. (J.S.R.)

3527 CEA-tr-A443

EVALUATION DES RISQUES COURUS LORS DE LA MANIPULATION D'ISOTOPES RADIOACTIFS. (Evaluation of the Risks Incurred in the Manipulation of Radioisotopes.) R. Berthold and O. Vaupel. Translated by M. Kleinberger from Atomwirtschaft 2, 88-93 (1957). 36p.

A study was made to estimate the dangers caused by radiation in the scientific, medical, and technical centers where radioisotopes are produced, handled, or utilized. Relative values were calculated of the risks which established the probable dangers as a function of the type and intensity of the emitter, its use, and the possible incidents. Preliminary values were obtained for the danger of radioactive materials under very diverse conditions. (J.S.R.)

3528 JPRS-1022

THE USE OF Co^{60} AND CS^{137} IN TELECURIE THERAPY. J. H. Mellink. Translated from Atompraxis 4, 212-27(1958). 44p.

Available from Photoduplication Service, Library of Congress.

Principles of radiotherapy affecting the design of cobalt-60 and cesium-137 teletherapy units are reviewed. Data are tabulated on the advantages and disadvantages of cobalt-60 as compared to cesium-137. Data on tissue dose and shielding requirements are also tabulated. The design of a telecobalt instrument is described. Clinical results since 1952 are summarized. (C.H.)

3529

EFFECT OF STABLE IODINE ON UPTAKE OF RADIOIODINE IN SHEEP. L. K. Bustad, D. E. Warner, and H. A. Kornberg (General Electric Co., Richland, Wash.). Am. J. Vet. Research 19, 893-4(1958) Oct.

Supplying iodized salt (in amounts approximating those used by many farmers) to sheep on a ration low in stable iodine reduced thyroid uptake of a single tracer dose of I^{131} by over 30 per cent. Inorganic iodine (KI) administered daily at levels of 2.5 mg to sheep, maintained on 5.0 and 0.15 μc of I^{131} daily, reduced thyroid uptake to less than 50 per cent of that of the controls. (auth)

3530

THE PATH OF CARBON IN PHOTOSYNTHESIS. XXIII. THE TENTATIVE IDENTIFICATION OF ERYTHROSE PHOSPHATE. V. Moses and M. Calvin (Univ. of California, Berkeley). Arch. Biochem. Biophys. 78, 598-600(1958) Dec.

Tentative evidence is presented of the occurrence of erythrose 4-phosphate in Chlorella allowed to carry on photosynthesis in the presence of $C^{14}O_2$. (C.H.)

3531

TRACE ELEMENTS IN HUMAN TISSUE. 3. STRONTIUM AND BARIUM IN NON-SKELETAL TISSUES. Eleanor M. Sowden (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Biochem. J. 70, 712-15 (1958) Dec.

A previously described method of estimating barium and strontium in bone ash by neutron activation has been modified to include non-skeletal tissues. Soft tissues collected from 31 cadavers have been examined. No marked accumulation of barium and strontium was apparent; lung and aorta were found to have the highest concentrations. (auth)

3532

BARIUM AND STRONTIUM CONCENTRATIONS IN EYE TISSUE. Eleanor Sowden and Antoinette Pirie (Atomic Energy Research Establishment, Harwell, Berks, Eng. and Univ. of Oxford). Biochem. J. 70, 716-17(1958) Dec.

The strontium and barium content of the different parts of the eye has been estimated by the method of activation analysis in cattle, rabbit, and man. The pigmented parts of the eye contain more strontium and barium than the other parts, and barium in particular is concentrated in the choroid of the cow. These results are discussed in relation to the presence of high concentrations of zinc in the choroidal tapetum lucidum of other animals. (auth)

3533

EFFECTS OF X RAYS ON THE HISTAMINEPEXIC

CAPACITY OF TISSUES. E. I. Krichevskaya and G. V. Kapitonova (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 68-71(1958) Nov. 1. (In Russian)

Studies were made to determine the relation between the radiation-induced changes of free histamine level in tissues and the disturbance in their histaminepexic capacity. (R.V.J.)

3534

THE PREPARATION AND BIOLOGICAL APPLICATION OF AIRBORNE SIMULANTS OF FALLOUT FROM NUCLEAR DETONATION. S. H. Cohn, W. B. Lane, J. C. Sherwin, J. K. Gong, and L. Weisbecker (U. S. Naval Radiological Defense Lab., San Francisco). J. Air Pollution Control Assoc. 7, 20-5(1957) May.

Laboratory studies were made of inhalation hazards from various types of nuclear detonations by exposing mice to fall-out simulants. Three types of fall-out simulants were developed by dissolving fission product chlorides in sea water. Dirt particles were added to two of the simulants. Information is presented on preparation, generation, and characteristics of the simulants. Data on uptake, distribution, and retention of one of these simulants in exposed animals are included. (J.H.M.)

3535

THE CONTROL OF LEUKOCYTE GLYCOLYSIS. William S. Beck (Univ. of California Medical Center, Los Angeles). J. Biol. Chem. 232, 251-70(1958) May.

Isolated human blood leukocytes have a predominantly aerobic glycolytic metabolism, but the rates of lactic acid production per cell are significantly lower in chronic myelocytic leukemia and chronic lymphocytic leukemia leukocytes than in normal ones. An attempt was made to explain these differences by identifying the rate-limiting or master reaction in the three tissues. (C.H.)

3536

OCCURRENCE AND CONTROL OF THE PHOSPHOGLUCONATE OXIDATION PATHWAY IN NORMAL AND LEUKEMIC LEUKOCYTES. William S. Beck (Univ. of California Medical Center, Los Angeles). J. Biol. Chem. 232, 271-83(1958) May.

The phosphogluconate pathway occurs in leukocytes, though less than 10 per cent of utilized glucose traverses this pathway. This per cent is higher in leukemic than in normal cells. The extent of phosphogluconate pathway metabolism is shown to be under direct control of the hexokinase level. The concentration of triphosphopyridine nucleotide and the efficiency of dihydrotriphosphopyridine-oxidizing systems also play a role in the control of phosphogluconate pathway metabolism but a secondary one, particularly in the steady state. The higher percentages of phosphogluconate pathway metabolism in leukemic cells are attributed to their deficiencies of hexokinase. Normal and leukemic leukocytes contain transaldolase and transketolase. The observed levels of phosphogluconate pathway metabolism were the same in homogenized and in intact cells. (auth)

3537

INTERRELATIONSHIP BETWEEN SERUM CALCIUM LEVELS: CALCIUM^{45} AND STRONTIUM^{85} METABOLISM IN MAN. Gianfranco Mazzuoli, Joseph Samachson, and Daniel Laszlo (U. S. Public Health Service and U. S. Atomic Energy Commission, New York). J. Lab. Clin. Med. 52, 522-32(1958) Oct.

The effect of acute elevation or depression of serum calcium upon the intestinal absorption and upon the metabolism of the absorbed calcium and strontium was investigated in two patients. The serum calcium was raised or lowered by a 6-hour infusion of calcium gluconate or sodium ethylenediaminetetraacetate. A tracer dose of Ca^{45} and Sr^{85} was administered orally at that time. Acute changes of the serum calcium levels had no significant influence on the absorption of either calcium or strontium; the absorption of Ca^{45} exceeded that of Sr^{85} under all conditions studied. The urinary excretion of Sr^{85} exceeded considerably that of Ca^{45} in the normocalcemic state. During hypercalcemia the excretion of both tracers increased; ethylenediaminetetraacetic acid caused a marked increment of Ca^{45} and a marked decrease of Sr^{85} excretion. The endogenous fecal excretion of Sr^{85} was slightly higher than that of Ca^{45} in all studies. (auth)

3538

INFLUENCE OF CHELATES ON THE METABOLISM OF RADIOYTTRIUM (Y^{90}). III. H. C. Dudley and Joseph Greenberg (U. S. Naval Hospital, St. Albans, N. Y. and Long Island Jewish Hospital, New Hyde Park, N. Y.). J. Lab. Clin. Med. 52, 533-40(1958) Oct.

Studies with rabbits and dogs following the systemic administration of radioyttrium (Y^{90}) chelated with ED-ol, at low carrier concentration, have shown that this metal may be caused to localize in bone, particularly in those areas having marked osteoblastic activity. The energetic beta emission irradiates the adjacent marrow. Titration of the dose of Y^{90} given resulted in a preferential effect on the components of the marrow and, hence, the peripheral blood. The lethal dose for rabbits was found to be 3.5 to 4.5 mc Y^{90} per kilogram and for dogs, 1.5 to 2.0 mc per kilogram. Sublethal doses produced typical radiation effects on the peripheral leukocytes (70 to 80 per cent reduction). The number of erythrocytes were not markedly reduced under these conditions. Control levels were regained by the leukocytes within 60 days after the Y^{90} injection. Chelated Y^{90} (2.0 mc) was administered intravenously to 6 terminal patients, 3 of whom came to autopsy. In the 2 patients given a carrier dose of 0.20 mg Y^{89} per kilogram the major localization was in the liver and spleen, whereas the patient given a carrier dose of 0.05 mg Y^{89} per kilogram showed significant localization in bone. Based on the results obtained in this study it is suggested that Y^{90} ED-ol, at low carrier concentration, may be useful in the management of malignant conditions involving the marrow and/or bone. Clinical trials of this modality are now actively underway in a wide variety of such conditions. (auth)

3539

KINETIC STUDIES OF SKELETAL METABOLISM BY EXTERNAL COUNTING OF INJECTED RADIOISOTOPES: THE RADIOISOTOPE OSTEOGRAM. Norman S. MacDonald (Univ. of California, Los Angeles). J. Lab. Clin. Med. 52, 541-58(1958) Oct.

Methods were devised for continuously recording variations of radioactivity in bone areas with time, following injection of bone-seeking radioisotopes. These graphic records were named radioisotope osteograms. By using gamma scintillation detectors and pulse-height analyzers, it was possible to record simultaneously on separate charts the fates of two different radioisotopes following injection of a mixture. These techniques were used in rabbits to compare the clearance from blood

and the accumulations in bone of Sr^{85}, Na^{22}, and I^{131}. Double tracer experiments with Sr^{85}, Cr^{51}-tagged erythrocytes, and I^{131}-labeled serum albumin elucidated certain kinetic aspects of calcium metabolism, such as vascular transport, transcapillary movements, ionic exchange, and bone salt accretion. Osteograms obtained after injection of Ba^{140}, La^{140}, and Sr^{85} mixtures showed that the behavior of Ba^{140} is quite similar to that of Sr^{85}, but radically different from that of La^{140}. Quantitative comparisons of long-term retentions of Sr^{85} and Na^{22} in various types of bone tissue were made. It was shown that information on the current metabolic status of a fracture can readily be obtained at any point during the course of healing. Osteograms showing the uptakes of Sr^{85} and Na^{24}- or I^{131}-labeled serum albumin during the first hour after their injection, followed by daily monitoring of the bone areas, provide the necessary data. Extension of the techniques to the study and diagnosis of metabolic disorders and lesions of the human skeleton is discussed. (auth)

3540

CHANGES IN THE SENSITIVITY OF ENZYMES IN THE DRY STATE TO RADIATION. Reinier Braams, Franklin Hutchinson, and Dilip Ray (Yale Univ., New Haven). Nature 182, 1506(1958) Nov. 29.

Evidence is presented that the effect of ionizing radiation on dried enzyme preparation can be altered by the addition of any one of several compounds. Data are tabulated. (C.H.)

3541

RADIOPROTECTIVE ACTION OF 5-HYDROXYTRYPTAMINE. H. A. S. van den Brenk and Kathleen Elliott (Cancer Inst. Board, Melbourne). Nature 182, 1506-7(1958) Nov. 29.

The effect of pretreating rats with antagonists and specific anti-metabolites preceding administration of 5-hydroxytryptamine and tryptamine before exposure to lethal doses of whole-body x radiation was investigated. Data are tabulated. The results point to a close correlation between the radioprotective action of certain amines and their respective pharmacological actions. (C.H.)

3542

RIBOSYL TRANSFER BETWEEN RIBOSE NUCLEOTIDES IN THE RAT. Georg B. Gerber and Kurt I. Altman (Univ. of Rochester, N. Y.). Nature 182, 1513-14(1958) Nov. 29.

Rats were injected with carbon-14 labeled cytidylic acid. Data are tabulated on the incorporation of carbon-14 activity in various tissue components related to the ribose pool. (C.H.)

3543

ANEMIA AND LIVER DAMAGE IN X-IRRADIATED ANIMALS. M. Skalka (Czechoslovak Academy of Sciences, Brno). Nature 182, 1602-3(1958) Dec. 6.

After whole-body exposure of mice and rats to high radiation doses a striking relation was found between a decrease in red blood cell count and an increase in the amount of total-liver fats. Data are tabulated. The relationship of severe anemia, anoxia, and liver damage in irradiated animals is discussed. (C.H.)

3544

EFFECT OF THYROID PRE-TREATMENT ON THE MORTALITY OF X-IRRADIATED MICE. M. Pospíšil and L. Novák (Academy of Sciences, Brno). Nature 182, 1603-4(1958) Dec. 6.

An investigation was made of the effect of thyroid pre-treatment on the mortality of x-irradiated mice. Changes in metabolism during adaptation to the irradiation chamber were measured. Animals for which general irradiation was fatal showed a reduction of the adaptation consumption of oxygen before their death. This reduction was interpreted as a failure of the capacity for adaptation of the nervous system and was found to be ameliorated by feeding the animals with thyroid prior to irradiation. This favorable effect upon the adaptation metabolic capacity of the animals resulted also in a higher survival of the irradiated mice. (C.H.)

3545

TRANSFORMATION OF A MONOCHLAMYDIUS INTO A DICHLAMYDIUS CHIMAERA BY X-RAY TREATMENT. H. W. Howard (Plant Breeding Inst., Cambridge, Eng.). Nature 182, 1620(1958) Dec. 6.

A report is presented of an x-ray treatment which resulted in a successful transformation of one variety of potato into a chimera. Data are tabulated. (C.H.)

3546

EFFECT OF TRIIODOTHYRONINE ON RADIOSENSITIVITY. Joseph A. Stein and Melvin L. Griem (Univ. of Chicago). Nature 182, 1681-2(1958) Dec. 13.

L-tri-iodothyronine sodium, the potent fraction of the thyroid hormone which acts rapidly at the cellular level, was selected to induce a hyperthyroidal state in tissues. The abnormal tissues used include a solid, non-metastasizing, non-systemic, myeloid chloroleukemia rat tumor, and a mouse neuroblastoma of similar biological action. When sufficient experimental results had been obtained to support the thesis that increased radiosensitivity resulted from induction of a hyperthyroidal state, two patients were selected for such treatment. The results of these experiments are discussed, and it was concluded that inasmuch as a basically radio-resistant tumor, like bronchogenic carcinoma, cannot ordinarily be eradicated even by large exposures, there may have been a fundamental, biological qualitative change in these neoplastic cells induced by the hormone triiodothyronine. (J.R.D.)

3547

ALLEGED SUSCEPTIBILITY OF SULPHYDRYL ENZYMES TO IONIZING RADIATION. A. Pihl, R. Lange, and L. Eldjarn (Norwegian Radium Hospital, Oslo). Nature 182, 1732-3(1958) Dec. 20.

Results are presented to show that the sulfhydryl enzymes, muscle glyceraldehyde-3-phosphate dehydrogenase and yeast alcohol dehydrogenase, are inactivated by x rays with about the same ionic yield as various non-sulfhydryl enzymes. Implications of the findings on concepts of the susceptibility of sulfhydryl enzymes to the indirect action of ionizing radiations are discussed. (C.H.)

3548

CHROMOSOME ABERRATIONS IN CALCIUM-DEFICIENT TRADESCANTIA PRODUCED BY IRRADIATION. Dale Steffensen (Brookhaven National Lab., Upton, N. Y.). Nature 182, 1750-1(1958) Dec. 20.

The lack of calcium in Tradescantia microspores and in barley seeds was shown to increase the frequency of x-ray-induced chromosome aberrations above similarly irradiated material grown with optimal calcium. Mechanisms by which the lack of calcium could cause such an effect are discussed. (C.H.)

3549

NEW MEDICAL IRRADIATION UNITS. D. S. Beard

and G. Munday. Nuclear Energy Engr. 12, 441-3(1958) Dec.

New irradiation units designed to treat tumors lying close to the skin and in such regions as the head and neck are described. Design details and application procedures are given for a cesium-137 unit and a twin-source cobalt-60 teletherapy unit. Schematics are included of each of the two units. (J.H.M.)

3550

THE PRODUCTION AND MEDICAL APPLICATIONS OF SHORT-HALF-LIFE RADIOISOTOPES. E. R. King, William S. Maxfield, Robert Sharp, and Robert Druyan (U. S. Naval Hospital and U. S. Naval Medical School, Bethesda, Md.). Radiology 71, 860-7(1958) Dec.

The construction of reactors in the immediate vicinity of a hospital will allow clinical applications of short-half-life materials and thus decrease the body radiation dose received during diagnostic radioisotope studies. Experiences with the 5-watt medical research reactor at the U. S. Naval Hospital are discussed from the viewpoint of production and separation of short-half-life radioisotopes and plans for their clinical utilization. Data are tabulated on the production and properties of 12 radioisotopes selected on the basis of usable activities and biological interest. Techniques using short-half-life isotopes which have been tried up to this time are reviewed, and future studies are proposed. Assumptions, based on previously published formulas, are presented for calculating the tissue radiation dose delivered by short-half-life radioisotopes. (C.H.)

3551

RADIATION DOSE RATE AND MUTATION FREQUENCY. W. L. Russell, Liane Brauch Russell, and Elizabeth M. Kelly (Oak Ridge National Lab., Tenn.). Science 128, 1546-550(1958) Dec.

New data have clearly confirmed the earlier finding that specific locus mutation rates obtained with chronic gamma irradiation of spermatogonia are lower than those obtained with acute x rays. Since this result is in contrast to classical findings for Drosophila spermatozoa, and apparently contradicts one of the basic tenets of radiation genetics, it was important to determine what factors were responsible for it. Experiments undertaken for this purpose reveal the following: the lower mutation frequency is due mainly to difference in dose rate of radiation, rather than quality; a dose-rate effect is not obtained in experiments with mouse spermatozoa, confirming classical findings for spermatozoa, and indicating that the explanation for intensity dependence in spermatogonia resides in some characteristic of gametogenic stage; and a dose-rate effect is found not only in spermatogonia but also in oocytes, where cell selection is improbable, indicating that the radiation intensity effect is on the mutation process itself. A threshold response for all mutations in spermatogonia and oocytes is not a necessary consequence of the findings. Plausible hypotheses consistent with the present results can lead to other predictions. From a practical point of view, the results indicate that the genetic hazards, at least under some radiation conditions, may not be as great as those estimated from the mutation rates obtained with acute irradiation. However, it should not be forgotten that even the lower mutation rates obtained with the present intensity levels are still appreciable. (auth)

3552

CONTROLLED STAINING OF AUTORADIOGRAPHS. J. A. Bergeron (Brookhaven National Lab., Upton, N. Y.). Stain Technol. 33, 221-3(1958) Sept.

The preparation of autoradiographs in which the tissue and the emulsion are in permanent register is often complicated by staining after the photographic image has been developed and fixed. While general oversight methods can be satisfactory, controlled, specific staining can be obtained with most basic dyes when the pH is properly regulated. The reactivity of the gelatin is suppressed at a pH of 4 or slightly below whereas nuclei, ergastoplasm, cartilage, mast cells, mucus, etc. stain readily. Basic fuchsin, .05% at pH 3.5 to 4.0 in dilute (1:10) McIlvaine buffer, is recommended. The final preparation contrasts in color and transparency with the black, opaque silver grains. (auth)

3553

RADIATION INJURIES OF CRANIAL BONES. M. D. Galperin and N. A. Zaichikova (Bekhterev Leningrad Psycho-Neurological Inst.). Vestnik Rentgenol. i Radiol. 33, No. 5, 96-8(1958) Sept.-Oct. (In Russian)

Descriptions are given of the observations made on two patients suffering from pathological alterations in the cranial bones due to an early radiation injury. (R.V.J.)

3554

APPLICATIONS OF ATOMIC SCIENCE IN AGRICULTURE AND FOOD. Paris, The Organisation for European Economic Co-Operation, 1958. 113p.

Twenty experts from 9 European countries visited the United States from March to June 1947, to obtain first-hand information on actual and potential applications of atomic energy in research work connected with problems in soils and plants, animal science, radiation biology, and food preservation. The participants visited a number of selected research and educational institutions and participated in a 4-week training program. A summary of information and general conclusions are presented. (C.H.)

3555

THE USE OF IONIZING RADIATION IN PLANT BREEDING: ACCOMPLISHMENTS AND PROSPECTS. Arnold H. Sparrow and Calvin F. Konzak (Brookhaven National Lab., Upton, N. Y.). pp. 425-51 in "Camellia Culture." E. C. Tourje, ed. The MacMillan Company, 1958.

Applications of radiation in plant breeding programs are summarized. The induction of useful plant mutations following irradiation is discussed. (C.H.)

CHEMISTRY

General

Refer also to abstracts 4307, 4311, 4317, 4319, 4320, 4321, 4323, 4331, 4336, 4340, 4344, 4346, 4348, and 4373.

3556 AECU-3924

Michigan. Univ., Ann Arbor and Oslo. Univ.
LOW TEMPERATURE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF TRIURANIUM OCTOXIDE. Edgar F. Westrum, Jr. and Fredrik Grønvold. [1958]. 16p. $3.30(ph OTS); $2.40(mf OTS).

The heat capacity of U_3O_8 was measured over the range 5 to 350°K. In addition, the enthalpy, entropy, and free energy increments were computed by numerical

integration, using graphically interpolated values of heat capacity. The heat capacity determinations are listed in tables and the heat capacity versus temperature values are presented graphically. (J.R.D.)

3557 AECU-3925
Michigan. Univ., Ann Arbor.
THE LOW-TEMPERATURE THERMAL AND CHEMICAL THERMODYNAMIC PROPERTIES OF BORON COMPOUNDS. Edgar F. Westrum, Jr. [1958]. 27p. Contract [AT(11-1)-70, Project 5]. $4.80(ph OTS); $2.70(mf OTS).

The current status of the low-temperature heat capacities and chemical thermodynamics of the boron compounds is surveyed. The published and recent unpublished data obtained by precision low-temperature adiabatic calorimetry in this laboratory on vitreous and crystalline sodium tetraborate, ammonia triborane, and trimethylamine triborane are discussed. The basic scientific information obtained from these data is presented, and, insofar as possible, the application is made to relevant technological applications. (auth)

3558 AECU-3927
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
FLOW PATTERNS IN VERTICALLY PARTITIONED SPRAY COLUMNS. James R. Kennedy and Domenic B. Vassallo. Jan. 20, 1956. 10p. For Carbide and Carbon Chemicals Co. K-25 Plant. Contract W-7405-eng-26, Subcontract 70. (KT-223). $1.80(ph OTS); $1.80(mf OTS).

A study of the flow patterns existing inside a vertically-partitioned glass spray column was made. A water-kerosene system was employed in which the water was the continuous phase, and the kerosene, which was dyed, was the discontinuous phase. Observations and colored motion pictures of the system flow patterns were made with an unbaffled column and with the column containing vertical plate partitions and vertical glass tables. It was concluded that the phase distribution in this type column is unstable, and channeling of the continuous and discontinuous phases occurs regardless of continuous phase distributor used. (J.R.D.)

3559 AECU-3960
Michigan. Univ., Ann Arbor.
THENOYLTRIFLUOROACETONE: POLAROGRAPHIC AND SPECTROPHOTOMETRIC BEHAVIOR, AND DISSOCIATION EQUILIBRIUM. MECHANISMS OF ELECTROCHEMICAL REDUCTION. Report No. 40. Philip J. Elving and Philomena G. Grodzka. Sept. 15, 1958. 45p. Contract AT(11-1)-70, Project 8. $9.30 (ph OTS); $3.60(mf OTS).

Thenoyltrifluoroacetone (TTA) gives four polarographic waves over the usual pH range, whose presence and properties depend upon the pH, the specific buffer used and the buffer component concentration. The report of only two TTA waves in a previous study is due to the large pH intervals between measurements. Spectrophotometric examination of TTA solutions, before and after controlled potential electrolysis at a massive mercury cathode, has made possible an explanation of the complex polarographic behavior on the basis of the various tautomeric and acid-base equilibria involving TTA species including assignment of the polarographic waves to the various TTA species present. Spectrophotometry indicates that the observed variations in the polarographic behavior of TTA in different alkaline buffers is probably due to specific catalytic effects of buffer components upon the specific rate constants for the conversion of ionized, nonreducible (at the potentials involved) TTA species to unionized, reducible species and not to borate complexation as previously suggested. (auth)

3560 AECU-3961
Michigan. Univ., Ann Arbor.
THE TIME-DEPENDENCE OF THE DIFFUSION-CONTROLLED POLAROGRAPHIC CURRENT. Report No. 41. Joseph M. Markowitz and Philip J. Elving. Sept. 1, 1958. 23p. Contract AT(11-1)-70, Project 8. $4.80(ph OTS); $2.70(mf OTS).

The experimental polarographic current vs. time relationship cannot be explained by the simple hypothesis, common to all previous theoretical developments, of constant initial concentration at the time when each drop begins to form, even when the degree of rigor of the mathematical development of the hypothesis is very high, and when account is taken of the inaccuracy of many of the other physical assumptions entering the formulation of the matematical theory. The postulatory basis of the theory was therefore revised to contain the alternate hypothesis that at the beginning of drop formation the region of solution around the electrode tip is depleted of electroactive material because of its removal by electrolysis at the preceding drop. Mathematical development of the revised diffusion problem for the dropping mercury electrode leads to a prediction for the current-time relationship which is substantially in agreement with the experimental data even during the early stages of drop growth. It can be inferred that the existence of a depleted region is an essential part of the physical situation. The mathematical development is capable of an indefinite amount of improvement through the fitting of certain parameters to the experimental data. (auth)

3561 AECU-3962(Pt. I)
Michigan. Univ., Ann Arbor.
THE FARADAIC ADMITTANCE OF ELECTROCHEMICAL PROCESSES. I. THEORETICAL TREATMENT. Report No. 42. Henry H. Bauer and Philip J. Elving. Aug. 14, 1958. 16p. Contract AT(11-1)-70, Project 8. $3.30(ph OTS); $2.40(mf OTS).

The fundamental equations proposed in the literature to derive expressions to characterize the faradaic admittance have two possible sets of solutions. In one method of derivation, the solution obtained depends on the assumption made as to the phase angle of the faradaic alternating current with respect to the alternating potential. In another derivation, one or the other solution is obtained according to whether a cathodic current is regarded as positive or negative in sign. (auth)

3562 AECU-3962(Pt.II)
Michigan. Univ., Ann Arbor.
THE FARADAIC ADMITTANCE OF ELECTROCHEMICAL PROCESSES. II. APPARATUS SUITABLE FOR PHASE ANGLE MEASUREMENT. Report No. 43. Henry H. Bauer and Philip J. Elving. Aug. 14, 1958. 16p. Contract AT(11-1)-70, Project 8. $3.30(ph OTS); $2.40(mf OTS).

An improved apparatus for measuring the effects of a small superposed sinusoidal potential on the behavior of electrochemical systems has been developed. From measurements of the series resistance, the capacity of the electrical double layer, and the gross alternating potential and current and phase angle, the characteristic

properties of the faradaic process including the phase angle can be readily calculated. The theoretical basis for the experimental procedure used is critically discussed; the procedure itself is given in detail. (auth)

3563 AERE-C/R-2723
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
FIELD LABORATORY METHODS FOR THE DETERMINATION OF URANIUM IN NON-SALINE WATERS. G. W. C. Milner and G. A. Barnett. Nov. 1958. 16p. $0.25(BIS).

A direct fluorimetric procedure is described for the rapid analysis of waters containing 1 μg or more of uranium per liter. Three separate 1 ml aliquots of a filtered and acidified sample are evaporated to dryness on fluorimeter dishes in the presence of magnesium in acetic acid. A standard uranium addition is made to one dish. Then organic material is removed by ignition in air, and each residue is fused with 0.5 g of mixed sodium fluoride–carbonate flux. The fluorescence of the cooled melts is determined with a fluorimeter, and the uranium content of the sample is calculated from the correlation of the results. For waters with lower uranium concentrations, a larger volume is taken for analysis, and a selective solvent extraction procedure is employed to separate and concentrate the uranium. A suitable filtered sample (100 ml) is evaporated to dryness in the presence of magnesium, and organic matter is destroyed by ignition. After re-solution of the residue, the pH is adjusted to between 6 and 7 in the presence of EDTA, and the uranium is extracted as its 8-hydroxyquinoline complex into chloroform. An aliquot of this extract is used for the fluorimetric determination. This procedure is suitable for water samples with uranium contents as low as 0.1 μg per liter. (auth)

3564 AERE-I/R-2745
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ADSORPTION OF CARBON MONOXIDE ON ZINC OXIDE. T. I. Barry and F. A. Brimelow. Nov. 1958. 15p.

Two types of carbon monoxide adsorption on zinc oxide were investigated. The results indicate that below 50°C carbon monoxide is adsorbed as $-C^{+} = 0$ with formation of a space change in a surface boundary layer. At temperatures above 150°C carbon monoxide is probably adsorbed as CO_2^{2-} on oxygen lattice sites. With increasing temperature carbon monoxide becomes irreversibly adsorbed and may be desorbed only as carbon dioxide. (auth)

3565 AERE-M/R-2579A
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A STUDY OF THE RATES OF CRYSTALLISATION OF IRON FROM LIQUID BISMUTH SOLUTIONS. D. H. Kerridge. Oct. 1958. 9p.

The rates of crystallization of iron from supersaturated solution in liquid bismuth were studied for several crystallization temperatures and supersaturations. The rates were found to agree with those given by the dislocation theory of crystal growth. Growth occurred on the nuclei present in the solution and not on the iron surfaces in contact with the supersaturated solution. The relative importance of the solution and crystallization processes in determining the rate of mass transfer is considered for liquid bismuth circulating through an iron thermal convection loop. (auth)

3566 AERE-M/R-2702
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CRYSTALLOGRAPHIC STUDIES OF GRAPHITES. G. E. Bacon. Oct. 1958. 48p.

An account is given of the structural crystallography of graphite based on x-ray-diffraction measurements on various polycrystalline samples. The latter range from highly crystalline materials down to those in which the structural imperfection approximates to misorientations every three or four carbon layers. Emphasis is placed on measurements of crystallite and unit-cell dimensions and crystalline perfection and the precise techniques and corrections necessary to achieve any approach to absolute measurement of these quantities. (auth)

3567 CEA-673 B
France. Commissariat à l'Énergie Atomique, Paris.
PURIFICATION PAR RESINES ECHANGEUSES D'IONS DE L'EAU LOURDE DES REACTEURS EL_1 ET EL_2. B. ETUDE DES PROPRIETES GENERALES DES RESINES UTILISEES. Cover carries title: PURIFICATION DE L'EAU LOURDE DES REACTEURS EL_1 ET EL_2. (The purification by ion exchange resins of the heavy water in the reactors EL_1 and EL_2. [Part] B. Study of the general properties of the resins used.) [R.] Platzer. 1957. 25p.

The ion exchange resins used in the purification of the heavy water in the EL 1 and EL 2 reactors were studied. The general properties of resins were investigated, and then a special study was made of the utilization of the resins, especially in an apparatus similar to those mounted on the reactors. The problem of aluminum suspension in the water from the EL 2 was also studied. (J.S.R.)

3568 CF-58-6-58
Oak Ridge National Lab., Tenn.
MOLTEN SALT COMPOSITIONS. J. P. Blakely. June 12, 1958. 12p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

A list of fused-salt mixtures which are of importance in molten salt research is presented. The list is a revision and extension of the list published in ORNL CF-57-6-81. The liquidus temperatures given are believed to be within 10°C of the correct values. (auth)

3569 HW-30331(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DETERMINATION OF NO_2 AND NO IN AIR. W. E. Gill. Sept. 17, 1958. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Several methods of nitrogen dioxide sampling and analysis were investigated in a laboratory study. A simple method was developed for preparation of known concentrations of nitrogen dioxide and nitric oxide. In 50 ml syringes containing Griess-Ilosvay type nitrogen dioxide absorbing reagents, color development occurred rapidly for approximately one hour. For greatest accuracy, color development should be allowed to continue for an hour before readings are taken. Griess-Ilosvay type reagents were not specific for nitrogen dioxide in that they reacted significantly with nitric oxide. The phenoldisulfonic acid method for de-

termination of nitrogen dioxide gave good recoveries in concentrations as low as 16 ppm, when a 500 ml air sample was used. Approximately 40% of the nitrogen dioxide, in mixtures of nitrogen dioxide and nitric oxide, was selectively adsorbed on four grams of 12 to 20 mesh silica gel when the nitrogen dioxide concentration did not exceed 100 ppm. (auth)

3570 HW-58146

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HYDRIDING OF ZIRCONIUM AND URANIUM IN ORGANIC COOLANTS. V. H. Troutner. Nov. 12, 1958. 19p. Contract W-31-109-Eng-52. $0.75(OTS).

A study was made of the corrosion of uranium and zirconium in organic coolants in the presence of hydrogen and low water concentrations. Zirconium reacts with hydrogen to form zirconium hydride. The presence of the organic coolant has no effect on the reaction. The extent of reaction depends on the temperature and the hydrogen partial pressure. In the absence of hydrogen no reaction occurs, but at low hydrogen partial pressures complete hydriding is possible. The rate at which zirconium hydrides depends on the temperature, the hydrogen partial pressure, and the presence of an oxide film on the metal. The rate of reaction increases with increasing temperature and hydrogen partial pressure. The presence of an oxide film, present initially on the metal or formed by low concentrations of water in the organic coolant, retards the rate of reaction. No difference was observed between zirconium and Zircaloy-2. (auth)

3571 IDO-14455

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PRELIMINARY X-RAY INVESTIGATIONS OF THE HYDRATES OF ZIRCONIUM TETRAFLUORIDE. R. L. Wells. Nov. 18, 1958. 12p. Contract AT(10-1)-205. $0.50(OTS).

In the studies of the dissolution of uranium–zirconium alloys used in nuclear reactor fuel elements, it was observed that insoluble salts were formed. A phase study of the zirconium–nitric acid–hydrofluoric acid system was undertaken to investigate the chemistry of the formation of these salts. Two of the numerous solid phases obtained in this study were tentatively identified as $ZrF_4 \cdot 3H_2O$ and $ZrF_4 \cdot H_2O$. It was reported that the compound $ZrF_4 \cdot 3H_2O$ may have the formula $H_2ZrOF_4 \cdot 2H_2O$ or $ZrOF_2 \cdot 2HF \cdot 2H_2O$. Also, it would be possible to write the formula for $ZrF_4 \cdot H_2O$ as H_2ZrOF_4 or $ZrOF_2 \cdot 2HF$. The two hydrates were identified by comparing x-ray-diffraction powder data with the published data. In order to obtain more knowledge of these hydrates a structural analysis by single crystal x-ray diffraction was initiated. (auth)

3572 IGO-AM/S-9

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF NITROGEN IN VANADIUM METAL. Apr. 17, 1956. 9p.

The metal is dissolved in hot 9M sulfuric acid assisted by the addition of hydrogen peroxide. The ammonia, separated by distillation from alkaline solution, is determined absorptiometrically using either sodium phenate/sodium hypochlorite reagent for samples containing 5 to 90 ppm combined nitrogen or Nessler's reagent for samples containing 90 ppm to 2% combined nitrogen. In the 5 to 90 ppm range results show a negative bias of about 5% with a coefficient of variation of ± 5% or better. At the 300 to 600 ppm levels the results show a quantitative recovery with a coefficient of variation of about ± 3%. (auth)

3573 IGO-R/W-2

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

COMPLEXES OF PLUTONIUM (IV) WITH PHENYLARSONIC ACID DERIVATIVES. PART II. 2-(o-ARSONOPHENYLAZO)-1:8-DIHYDROXY-3:6-NAPHTHALENEDISULPHONIC ACID (URANOL), AND OTHERS. D. W. Ockenden. Feb. 1, 1956. 37p. (IGC-ARDC/P-150).

It is shown that tetravalent plutonium and uranol form a violet blue complex in 0.1M nitric acid solution. The complex was formed quantitatively and immediately only over the pH range 0.95 to 1.35. The dissociation constant of the complex is approximately determined, and the behavior of other ions, e.g., UO_2^{2+}, Fe^{3+}, Cr^{3+}, Al^{3+}, La^{3+}, and Th^{4+}, with the reagent was studied. Unfortunately, owing to slight fading, this reagent is no better for the absorptiometric determination of plutonium than thoronol (1-(o-arsonophenylazo)-2-naphthol-3:6-disulphonic acid). Many other reagents of similar structure have been investigated for this purpose, but few show any appreciable reaction with tetravalent plutonium even in the ultra-violet region. (auth)

3574 IGR-TN/CA-387

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

THE STABILISATION OF COPPER AND NICKEL APPARATUS AGAINST CORROSION BY ANHYDROUS HYDROGEN FLUORIDE. R. E. Worthington. Sept. 20, 1956. 9p. (IGC-CTC/R-182).

Unfluorinated nickel and copper apparatus reacts rapidly with hydrogen fluoride to form hydrogen and the appropriate metal fluoride. Prefluorination of the apparatus with hydrogen fluoride has no protective effect. Prefluorination with chlorine trifluoride prevents subsequent attack by hydrogen fluoride only if it is performed at a temperature which is 40 to 50°C higher than the reaction temperature used with the hydrogen fluoride. (auth)

3575 ISC-1051

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN ENGINEERING FOR JANUARY–JUNE 1958. Sept. 8, 1958. 33p. Contract W-7405-eng-82. $1.00(OTS).

Chemical Engineering. A 10-stage simulated column extraction run was made to determine if TBP was selective for N^{14} or N^{15} when the nitrogen was present as a nitrate. A technique is being developed for accurately measuring entrainment in bubble cap trays using radioactive isotopes as tracers. A summary of dynamic corrosion tests on stainless and carbon steel in Pb–Bi eutectic is given. The extraction of Mg from molten Mg–Bi alloys with a 54M% $ZnCl_2$–KCl eutectic is described. Research was undertaken to develop an economical processing method for recovering pure rare earths from bastnaesite ore. Low oxygen content YF_3 was prepared by hydrofluorinating the oxide at 600 to 800°C for a minimum of 8 hours using anhydrous hydrofluoric acid. The investigations on the separation of Ce as ceric oxide from rare earth nitrate mixture by

fusion with magnesium nitrate hexahydrate and sodium nitrate were continued. Nuclear Engineering. A special two-stage Ta loop was constructed to determine heat transfer and the flow rates of 5 wt. % U–95 wt. % Bi eutectic. Yttrium metal was used as a container material for a U–Cr eutectic and has operated at temperatures of 1000°C for several thousand hours. Ceramic Engineering. The preliminary sintering characteristics which occur in fine Al_2O_3 powders were defined in the temperature interval of 25 to 1200°C. (For preceding period see ISC-978.) (W.L.H.)

3576 ISC-1056
Ames Lab., Ames, Iowa.
ION-EXCHANGE SEPARATION OF METALS BY A SINGLE-PASS METHOD. Richard T. Oliver and J. S. Fritz. June 1958. 44p. Contract W-7405-eng-82. $1.25(OTS).

A single-pass method for the ion-exchange separations of binary mixtures of metals is described, and experimental applications are presented. The method consists of complexing each of the components in the mixture with a separate complexing agent at a pH sufficient to ensure maximum coördination of the metals. The complexing agents are chosen such that the metal complexes formed are of opposite charge. The mixture is then passed through an ion-exchange resin which absorbs one species completely, allowing the other to be collected in the effluent. An anion- or cation-exchange resin is used. Sulfosalicylic acid was used to form a negative complex with iron, uranium, aluminum, thorium, zirconium, and yttrium. Ethylenediamine was used to form a positive complex with copper, zinc, nickel, or cadmium. Quantitative separations of binary mixtures containing one metal from each of these groups were performed at pH values 8, 9, and 10 using Dowex (nuclear sulfonic cation exchange resin) and amberlite IRA-401 (quaternary amine anion-exchange resin). (auth)

3577 ISC-1074
Ames Lab., Ames, Iowa.
CRYSTAL STRUCTURE AND MAGNETIC PROPERTIES OF $LiCuCl_3 \cdot 2H_2O$. Peter H. Vossos and R. E. Rundle. Aug. 1958. 54p. Contract W-7405-eng-82. $1.50 (OTS).

Interest in the study of the effect of cation size upon the configuration assumed by a complex anion led to the determination of the crystal structure of $LiCuCl_3 \cdot 2H_2O$. A unique $(Cu_2Cl_6)^{2-}$ dimer ion was discovered in the structure that was determined by conventional x-ray diffraction techniques. These dimer ions are linked together into a zigzag chain by means of long Cu-Cl bonds between the dimers. The chains in any given unit cell of the crystal are related to each other by a two-fold screw axis. Each dimer has two water molecules associated with it through long Cu-O interactions, giving a distorted octahedral array about each copper ion. There are two additional water molecules per dimer ion which are lattice waters and which, along with one of the other oxygens and a chlorine ion, form a tetrahedral hole in which the lithium ion is probably located. (auth)

3578 NAA-SR-2939
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
X-RAY DIFFRACTION DATA FOR ANHYDROUS $BiCl_3$ AND $BiBr_3$. G. M. Wolten and S. W. Mayer. Oct. 1, 1958. 15p. Contract AT-11-1-GEN-8. $0.50(OTS).

Powder patterns of anhydrous $BiCl_3$ and $BiBr_3$ were obtained and indexed. The unit cells are primitive cubic, with lattice parameters of 8.14 and 9.23 A for the chloride and the bromide, respectively. The probable space group is P 2_1 3. $BiCl_3$ has the same structure at 220°C as at room temperature. (auth)

3579 NAA-SR-2964
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DISSOCIATION PRESSURE AND STABILITY OF BERYLLIUM CARBIDE. B. D. Pollock. Nov. 1, 1958. 12p. Contract AT-11-1-GEN-8. $0.50(OTS).

Equilibrium pressures for the reaction $\frac{1}{2}Be_2C(s) = Be(g) + \frac{1}{2}C(s)$ were measured in the temperature range of from 1430 to 1669°K, using the Knudsen technique. The dissociation pressure in this temperature range is given by the equation $\text{Log } P(\text{atm}) = 7.026 \pm 0.347 \times [-(19{,}720 \pm 537)]/T$. The heat and free energy of formation of beryllium carbide were derived from the aforementioned equation in combination with the literature vapor pressure data for solid beryllium. (auth)

3580 NP-7084
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
PREPARATION OF PURE BORON TRIFLUORIDE. J. T. Riedel. June 1958. 13p.

A laboratory method was developed for preparing chemically pure boron trifluoride for the technology of radiation detectors and as a starting material for enriching B^{10} contents of boron trifluoride. The crude boron fluoride obtained in the reaction vessel was subsequently purified by fractional distillation. Further purification involved transformation into an ether compound, which is also the starting compound for the preparation of calcium or barium fluoborate. The latter compounds make it possible to store any amount of BF_3 in a chemically stable form. The boron fluoride contained in either of the products can be recovered in roughly 90% yield by pyrolysis. (auth)

3581 NP-7090
Melpar, Inc., Falls Church, Va.
SYNTHESIS OF THERMALLY STABLE EPOXY RESINS FOR DIELECTRIC APPLICATIONS. Quarterly Progress Report No. 3 [for] September 16, 1958 to December 15, 1958. L. P. Glekas. 24p. Project No 8(8-73171). Contract AF33(616)-5518.

Of particular importance in this program is the development of epoxy resins containing phosphorus. This report includes: (1) the synthesis effort on the preparation of hydroxyphenyl containing phosphorus compounds; (2) reactions of tris-(hydroxymethyl phosphine) oxide with Allyl Glycidyl Ether; and (3) additional reactions of tetrakis (hydroxymethyl) phosphonium chloride and tris(hydroxymethyl phosphine oxide with epichlorohydrin. The reactions of THPC or THPO and epichlorohydrin were studied in greater detail with the objective of preparing a phosphorus containing epoxide. It was proposed that the epoxide might be prepared by a two-step reaction involving: (1) the acid catalyzed condensation of epichlorohydrin and THPC or THPO to give a compound containing chlorohydrin groups, and (2) dehydrohalogenation of the chlorohydrin groups with base resulting in ring closure and formation of epoxide groups. The acid catalyzed condensation of epichlorohydrin and THPC has yielded viscous liquids which have essentially no epoxide groups. Ring closure of these materials with base has given rise to insoluble, infusible, and apparently crosslinked polymers. (auth)

3582 NP-7102
Narmco, Inc., San Diego, Calif.
DEVELOPMENT OF EXO-REACTANT INORGANIC ADHESIVE SYSTEM. Quarterly Report No. 1 [for] July 1–September 30, 1958. Leonard Suffredini and Roger A. Long. Oct. 1, 1958. 39p. Contract NOas-58-857-c.

Exothermic reactions between various reactant metals and metal oxides can be theoretically determined and experimentally produced having ignition temperatures ranging from 450 to 1860°F, durations of from instantaneous to 64 seconds, and with maximum reaction temperatures estimated from 1200 to over 3000°F. Also, experimental indications were obtained that a number of these reactions could be controlled to give "useful heat conditions," within certain temperature limitations, by varying stoichiometry and reactant materials, particle size, and distribution. (auth)

3583 ORNL-2150(Del.)
Oak Ridge National Lab., Tenn.
A PHYSICAL PROPERTY SUMMARY FOR FLUORIDE MIXTURES. S. I. Cohen, W. D. Powers, and N. D. Greene. Sept. 5, 1956. Decl. with deletions Nov. 13, 1958. 117p. Contract W-7405-eng-26. $18.30(ph OTS); $6.00(mf OTS).

A summary of certain experimentally determined physical properties of fluoride mixtures which were formulated at ORNL is presented. These properties include the density, enthalpy, heat capacity, heat of fusion, thermal conductivity, viscosity, Prandtl number, electrical conductivity, and surface tension. In addition to the experimental data, values were predicted for the heat capacity and density of the other mixtures from the correlations of these properties. Estimates of the viscosity were also made for a number of the mixtures on which no experimental data were available. (auth)

3584 ORNL-2396
Oak Ridge National Lab., Tenn.
GUIDE TO THE PHASE DIAGRAMS OF THE FLUORIDE SYSTEMS. J. E. Ricci. Dec. 3, 1958. 117p. Contract W-7405-eng-26. $2.75(OTS).

The phase equilibria occurring in the fused fluoride systems investigated by the Fused Salt Chemistry Section of Oak Ridge National Laboratory are discussed in detail. (T.R.H.)

3585 USNRDL-TR-285
Naval Radiological Defense Lab., San Francisco.
AN APPARATUS FOR THE CONTROLLED FLAME COMBUSTION OF FILTER PAPER. M. Homma and A. E. Greendale. Oct. 20, 1958. 16p.

A new apparatus and technique is described for the controlled flame combustion of filter paper and cloth. The sample is burned in an atmosphere of oxygen at a reduced pressure within a pyrex glass cylinder. A detailed description is given of the operation of the apparatus. The numerous advantages of this system over previous methods are enumerated. The apparatus can be scaled up or down in size and can also be used with gases other than oxygen. Since it is possible to contain completely the sample during the combustion and to collect the products of combustion, it appears to be an extremely efficient system for quantitative determinations and for use with radioactive materials and toxic chemicals. (auth)

3586 WADC-TN-57-294
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
DETERMINATION OF HYDROGEN IN ZIRCONIUM HYDRIDE. [Period covered] September 1955 to September 1956. Wade H. Jones. Oct. 16, 1957. 9p. (AD-142186; PB-131972). $0.50(OTS).

A simple, rapid, precise method for determination of hydrogen in zirconium is described. It is based on the measurement of the equilibrium pressure of hydrogen over the metal in a closed system under predetermined conditions. The results of analysis of 35 samples at temperatures ranging from 1900 to 1000°C and collection times from 10 to 30 minutes are reported. (auth)

3587 WAPD-PM-22(Del.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE CHEMICAL REACTION OF ZIRCONIUM–URANIUM ALLOYS AND WATER AT HIGH TEMPERATURES. William N. Lorentz. July 1955. Decl. with deletions Aug. 13, 1958. 32p. $4.80(ph OTS); $2.70(mf OTS).

Rapid self-sustaining reactions between Zr–U^{235} alloy and water did not occur below the melting point of Zr in tests performed to define conditions under which such a chemical reaction would occur. Above the melting point of Zr the reaction proceeds very rapidly but not explosively. (J.E.D.)

3588 WCAP-918
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF CHLORIDE AND FLUORIDE IN METAL OXIDES, SALTS, AND SOLUTIONS. B. D. La Mont and B. W. Conroy. May 16, 1958. 19p. $3.30(ph OTS); $2.40(mf OTS).

Nuclear power reactors and high-pressure boilers constructed of stainless steel are subject to stress corrosion in the presence of chloride and fluoride in oxygenated systems. Consequently, determinations made for chloride (0.5 to 15 μg) and fluoride (0.5 to 50 μg). A procedure involving bleaching of the mercury diphenylcarbazone complex is used to determine chloride. Fluoride is measured by the bleaching of the thorium–"thorin" complex. These procedures were successfully applied to samples of metal oxides, salts, and solutions. (auth)

3589 AEC-tr-3427
THE EQUILIBRIUM CONSTANTS OF THE REACTION BETWEEN POTASSIUM BROMO- AND IODOMERCURIATES AND ALKALI. A. P. Kostiuk and V. A. P'iankov. Translated for Los Alamos Scientific Lab. from Zhur. Neorg. Khim. 2, 1535-7(1957). 4p.

A study of the equilibria in the reaction between potassium bromo- and iodomercurates and alkali was made. The equilibria for the complexes were calculated and found to be 5×10^{-1} for the bromide complex and 1.08×10^{-4} for the iodide complex. (auth)

3590 AEC-tr-3504
THE SULFIDES OF URANIUM. Marius Picon and Jean Flahaut. Translated by Liz Appleby (Hanford Atomic Products Operation) from Bull. soc. chim. France, 772-80(1958). 31p.

Six compositions were characterized in the sulfur–uranium system including the polysulfide US_3, the normal sulfide US_2 which exists in three distinct crystalline forms, and the subsulfides U_3S_5, U_2S_3, and US. There also exists an oxysulfide, UOS. The condition of their formation and their principle physical properties were studied, and crystallographic determinations made on all the isolated species. The state of uranium in all these compositions is discussed with the help of magnetic and crystallographic data. In all cases the

uranium is in the state of the U^{4+} ion; some metallic properties appear in the subsulfides. (auth)

3591 AEC-tr-3513
VOLUME CHANGES DURING NEUTRALIZATION. J. J. Saslawsky, E. G. Standel, and W. W. Towarow. Translated by K. S. Bevis (Savannah River Lab.) from Z. anorg. u allgem. Chem. 180, 241-51(1929). 12p.

The volume change which occurs during neutralization of acid and base solutions was experimentally determined in the five systems KOH–CH_3COOH, NaOH–CH_3COOH, NaOH–HNO_3, NH_3–HNO_3, and NaOH–H_2SO_4 at different concentrations and with various precentages of the components. (W.L.H.)

3592 AEC-tr-3520
THE THEORY OF TEMPERATURE DEPENDENCE OF THE COORDINATION NUMBER OF IONS IN AQUEOUS SOLUTION. O. Y. Samoylov. Translated by S. J. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 121, 1043(1958).

The temperature dependence of the coordination number (number of water molecules directly surrounding an ion in dilute aqueous solution) is investigated theoretically. (T.R.H.)

3593 CEA-tr-A194
UNE MÉTHODE SIMPLE ET RAPIDE POUR LA DÉTERMINATION DES CONSTANTES DE RÉSEAU À ± 0,00005 KX AU MOYEN DU GONIOMÈTRE À COMPTEUR. (A Simple and Rapid Method for the Determination of Lattice Constants at ± 0.00005 KX by Means of a Goniometer with Counter). F. Ebert. Translated from Z. Metallk. 45, 436-9(1954). 16p.

A rapid and simple method is described which permits a precision of measurement of ± 0.00005 KX by utilizing a goniometer with a counter tube and by measuring the lattice planes with low index, α (110) and γ (111), of the iron lattice. The Cr (110) reference ray is used for comparison. The method can be used for tests in series, the total test time being 20 min/object analyzed. The method is illustrated by an example. The correction factors which complete the measurement of the angle, such as the decentering of the object, the thickness of the layer of the standard used, and the effect of the coefficient of dilation, are discussed in detail. The observations made with the Berthold goniometer are studied critically. The curves obtained for cobalt and chromium with the plains of the iron lattice α (110) and γ (111) are given. (tr-auth)

3594 CEA-tr-A360
SUBSTITUTION DU FLUOR HYDROXYLE DANS L'HYDROXYLAPATITE COMME RÉACTION D'ÉCHANGE D'IONS ET SON EMPLOI POUR LA MICROANALYSE DU FLUOR. (Substitution of Fluorine and Hydroxyl on Hydroxylapatite as an Ion Exchange Reaction and its use for the Microanalysis of Fluorine.) A. Knappwost. Translated by M. Bronicki from Angew. Chem. 68, 371-3(1956). 13p.

The exchangeability of hydroxyl ions on hydroxyapatite is used to determine small quantities of fluorine. Fluorine ions are captured or freed reversibly by hydroxyapatite if the F^- concentration does not exceed the solubility product of CaF_2. Thus fluorine can be separated from a sample quantitatively and simply and determined by titration. (T.R.H.)

3595 CEA-tr-A363
NOUVELLE METHODE DE SEPARATION DES TERRES RARES. (New Method for the Separation of Rare Earths.) W. Fischer, W. Dietz, and O. Jubermann. Translated by B. Moreau from Naturwissenschaften 23, 348(1937). 3p.

The use of fractional extraction between two nonmiscible liquid phases was investigated for the separation of rare earths. It was shown that this method gives satisfactory results. (J.S.R.)

3596 CEA-tr-R388
I. ETUDE DES COMPOSÉS COMPLEXES DE NEODYME, PRASÉODYME ET ERBIUM AVEC L'ACIDE CITRIQUE PAR LA MÉTHODE SPECTROGRAPHIQUE. (Study of the Complex Compounds of Neodymium, Praseodymium, and Erbium with Citric Acid by a Spectrophotometric Method. I.) V. M. Pechkova and M. I. Gromova. Translated by B. Vinogradoff from Zhur. Neorg. Khim. 2, 1356-64(1957). 20p.

Modifications in the absorption spectra of the salts of Nd, Pr, and Er in the presence of citric acid make it possible to follow the formation processes of these elements. The formation processes depend on the element/citric acid ratio and on the pH of the solution, which is proved by the displacement of the absorption maxima of Nd and Pr towards the longer wave lengths and by the appearance of a new peak in the absorption maximum of Er near the short wave lengths. For large values of the ratio element/citric acid, the formation of four complexes with citric acid for definite pH intervals is established by the displacement of the absorption maxima of Nd and Pr. The complexes of Pr are formed for larger pH values than those of Nd. In an alkaline medium, the compounds of Pr are less stable than those of Nd and decompose at pH values higher than 12.7. For erbium, in the same conditions, only one complex was found in which the absorption maximum is displaced towards the shorter wave lengths with respect to the absorption maximum of erbium salts. A comparison of the data obtained with that from the chromatographic separation of Pr and Nd, with citric acid as eluant, shows that the best results for the separation are obtained with an eluant pH which corresponds to the beginning of the complex formation (1.6 to 2.4). (tr-auth)

3597 CEA-tr-R454
DOSAGE ANALYTIQUE ET SPECTROGRAPHIQUE DES ADDITIONS DANS LE TITANE. (Analytic and Spectrographic Determination of Additions in Titanium.) L. N. Filimonov, A. I. Essen, and Z. A. Zakharova. Translated by B. de Trezvinsky from Zavodskaya Lab. 23, 1313-15(1957). 9p.

A method is given for the spectrographic determination of magnesium, manganese, iron, silicon, tungsten, aluminum, nickel, cobalt, vanadium, molybdenum, chromium, and niobium in commercial titanium. The determination of less than 0.02% Si and 0.04% Fe is uncertain because of the absence of sufficiently pure standards. (J.S.R.)

3598 CEA-tr-R467
ANALYSE SPECTROGRAPHIQUE DES ALLIAGES A BASE DE TITANE. (Spectrographic Analysis of Alloys with a Titanium Base.) K. A. Moisseeva, K. A. Sukhenko (Soukhenko), S. I. Mladentzeva, and A. V. Aksenova. Translated by B. de Trezvinsky from Zavodskaya Lab. 23, 1316(1957). 3p.

A method for the quantitative spectrographic determination of Al, Cr, Fe, and Si in Ti-base alloys is presented. (J.S.R.)

3599 CEA-tr-R469
ANALYSE DES HALOGENES DANS LES OXYDES DIFFICILEMENT VOLATILS. (Analysis of Halogens in

Non-Volatile Oxides.) M. P. Chaika (Tchaika). Translated by M. Geystor and B. De Trezvinsky from Optika i Spektroskopiya 2, 421-5(1957). 14p.

A spectrographic method for determining small quantities of F and Cl in uranium oxide and thorium oxide is given. The luminous source is a hollow-cathode discharge tube. The method permits determination of F in concentrations as low as 10^{-4}%. The precision of the method is about 10%. Statements concerning the mechanism of passage of the analyzed mixture through the discharge zone are given. (tr-auth)

3600 CEA-tr-R470

DETERMINATION PAR METHODE SPECTROGRAPHIQUE DU CALCIUM, DU MAGNESIUM, DU CUIVRE, DE L'ALUMINIUM, DU FER, DU TITANE ET DU BORE DANS LE SILICIUM DE HAUTE PURETÉ (Spectrographic Determination of Calcium, Magnesium, Copper, Aluminum, Iron, Titanium, and Boron in Silicon of High Purity.) R. R. Chvanguiradze and T. A. Mozgovaya (Mozgovaia). Translated by B. de Trezvinsky from Zhur. Anal. Khim. 12, 708-13(1957). 18p.

A spectrographic method for the quantitative determination of Ca, Mg, Cu, Al, Fe, and Ti in high-purity silicon is described. A special method for the determination of 2×10^{-4}% of boron in silicon is given. (tr-auth)

3601 CEA-tr-R474

OBTENTION DES SPECTRES D'ARC ET D'ÉTINCELLE DU GADOLINIUM, DU DYSPROSIUM, DE L'ERBIUM ET DU THULIUM DANS UN ARC À COURANT ALTERNATIF. (Obtaining Arc and Spark Spectra of Gadolinium, Dysprosium, Erbium, and Thulium in an A.C. Arc.) A. I. Akimov. Translated by M. Bouchicot and B. Trezvinsky from Optika i Spektroskopiya 3, 545-51 (1957). 16p.

A method is described for obtaining the arc and spark spectra of rare earths, based on evaporation of a thin layer of the material from the surface of a graphite electrode. Data obtained by this method for the lines of Er I and II, Dy I and II, and Tm I and II are given and compared with that of other workers. (T.R.H.)

3602 CEA-tr-R478

INFLUENCE DE LA NITRURATION SUR LES RÉSULTATS DE L'ANALYSE SPECTRALE ET MOYENS DE SUPPRIMER L'EFFET OBSERVÉ. (Effect of Nitridation on the Results of Spectral Analysis and Means of Suppressing the Observed Effect.) I. A. Grikit (Grikite). Translated from Zavodskaya Lab. 23, 1347-51(1957). 17p.

The effect of nitridation on the spectral analysis of steels was investigated. Steel samples received various thermal and chemical treatments, and the spectra were photographed. The results showed that after nitridation too low values were obtained for the content of Si, Cr, Mn, Mo, and Al and too high a value for Ni. Thermal treatment and deformation of the sample had no effect on the spectral analysis. The use of a copper electrode instead of the graphite electrode suppresses the effect of the nitridation. The causes of the nitridation effect are discussed. (J.S.R.)

3603 CEA-tr-R489

DÉTERMINATION SPECTROGRAPHIQUE SEMI-QUANTITATIVE DU BORE DANS LES MINERAIS ET DANS LES MINÉRAUX. (Semi-Quantitative Spectrographic Determination of Boron in Ores and Minerals.) B. M. Maslennikov and L. V. Romanova. Translated by [B.] de Trezvinsky from Zavodskaya Lab. 23, 1327-8(1957). 8p.

A spectrographic method is described for the semi-quantitative determination of boron in carbonate and silicate rocks and in tourmalines. The absolute sensitivity of the method is 0.001% of boron. It can be increased to 0.0001% by an increase of the current intensity. The effect of Na and K on the boron determination was studied, and less than 2% of either does not affect the analysis. More than 5% of iron will interfere with the determination of low boron contents (less that 0.01%). (J.S.R.)

3604 NP-tr-192

MONOHYDROGEN URANYL PHOSPHATE $HUO_2PO_4 \cdot 4H_2O$ AND MONOHYDROGEN URANYL ARSENATE $HUO_2AsO_4 \cdot 4H_2O$. Armin Weiss, Kurt Hartl, and Ulrich Hofmann. Translated by M. H. Rand (U.K.A.E.A., Atomic Energy Research Establishment) from Z. Naturforsch. 12b, 669-71(1957). 10p.

The compounds $UO_2HPO_4 \cdot 4H_2O$, and $UO_2HAsO_4 \cdot 4H_2O$ are hydronium–uranium–micas which crystallize in square, optically uniaxial plates. Their powder diagrams could be indexes as tetragonal crystal. The proof of their structure was established by x rays, by thermal dehydration tests, and by solubility investigations. (J.R.D.)

3605 NP-tr-204

ON THE ADSORPTION OF THE Cs^+ ION ON THE SURFACE OF A MERCURY ELECTRODE. B. B. Damaskin, N. V. Nikolaeva-Fedorovich, and A. N. Frumkin. Translated for Lincoln Lab., MIT from Doklady Akad. Nauk S.S.S.R. 121, 129-32(1958). 8p.

It was shown in previous work that superequivalent adsorption of Cs^+ and La^{3+} cations is observed on the negatively charged surface of a mercury electrode. The difference in the magnitudes of the differential capacities at the zero charge point between Li^+ and Cs^+ in 0.01 N solutions of chlorides was presented as a proof as was also the difference in the potentials at which a difference in the magnitudes of the capacity for 0.1 N solutions of NaCl–NaI and CsCl–CsI vanishes. However, these experimental results are complicated by the specific adsorption of the Cl^- and I^- anions, which influence the cation adsorption on the surface of the mercury electrode. In order to avert this complication when investigating the superequivalent adsorption of cations related to the specific adsorption of anions, measurements were made in solutions of sodium and cesium fluoride since the F^- anion is not specifically adsorbed on mercury. (auth)

3606

USAF TESTS SYNTHETIC HYDRAULIC FLUIDS. Michael Yaffee. Aviation Week 70, No. 1, 71, 73, 75, 77, 79, 81-3, 85(1959) Jan. 5.

Information on the development of high-temperature hydraulic fluids for advanced aircraft and space-craft is presented. The need for these fluids is being met by the development of synthetic chemical compounds for operation in the 400 to 1000°F range. Discussions are included on: high-temperature problems, the application of cooling devices; radiation-resistant fluids for nuclear-powered aircraft, and the properties of polyphenyl ethers and other materials for use at temperatures above 700°F. (J.H.M.)

3607

SEMI-QUANTITATIVE DETERMINATION OF BERYLLIUM BY RISING PAPER CHROMATOGRAPHY.

H. Agrinier. Bull. Inform. sci. et tech. No. 22, 10-11 (1958) Oct. (In French)

A brief report is presented on a paper chromatographic method for the semi-quantitative determination of beryllium in minerals. 0.001% of Be could be detected by this method. (J.S.R.)

3608

A CRITICAL ANALYSIS OF PITTING CORROSION. N. D. Greene (Electro Metallurgical Co., Niagara Falls, N. Y.) and M. G. Fontana (Ohio State Univ., Columbus). Corrosion 15, 25t-31t(1959) Jan.

A critical analysis of the literature on pitting corrosion published during the past 35 years is presented. The definition of pitting and the factors influencing this type of attack are considered. An examination of the theories of pitting corrosion and the methods used to study this form of corrosion are also included. (auth)

3609

AN ELECTROCHEMICAL STUDY OF PITTING CORROSION IN STAINLESS STEELS. PART 1. PIT GROWTH. N. D. Greene (Electro Metallurgical Co., Niagara Falls, N. Y.) and M. G. Fontana (Ohio State Univ., Columbus). Corrosion 15, 32t-8t(1959) Jan.

By means of a unique artificial pit specimen, pit growth on 18% chromium–8% nickel stainless steel was measured and characterized. The effects of solution composition, agitation, atmosphere, corrosion current interruption, chloride ion concentration, and inhibitor additions have been investigated. Pit interaction during pit growth has also been determined. The autocatalytic nature of pitting was verified, and evidence of ion screening at pit sites was experimentally observed for the first time. (auth)

3610

AN ELECTROCHEMICAL STUDY OF PITTING CORROSION IN STAINLESS STEELS. PART 2. POLARIZATION MEASUREMENTS. N. D. Greene (Electro Metallurgical Co., Niagara Falls, N. Y.) and M. G. Fontana (Ohio State Univ., Columbus). Corrosion 15, 39t-44t (1959) Jan.

The artificial pit technique has been used to study the electrochemistry of the pitting corrosion of 18 percent chromium–8 percent nickel stainless steel in ferric chloride solutions. Pitting corrosion has been observed to be a highly complex, time-dependent phenomenon. The concepts of polarization and electrochemical control must be modified when applied to pitting attack. A new concept of electrochemical action during pitting, based on the mixed potential theory, has been proposed. (auth)

3611

EQUILIBRIUM DISTRIBUTION OF DEUTERIUM IN THE CASE OF HYDROGEN EXCHANGE WITH LIQUID HYDROGEN CHLORIDE. Ya. M. Varshavskii, S. E. Vaisberg, and B. A. Trubitsyn (Karpov Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 122, 831-3 (1958) Oct. 11. (In Russian)

The α value for isotopic equilibrium between hydrogen chloride and the aromatic C–H bond was secured; the obtained value was compared with α for the cases of the O–H bond and the aliphatic C–H bond. Experiments for isotopic exchange in hydrocarbons were made with a chloride aluminum catalysis. In addition to experimental determination of the α value for the water system (liquid) and hydrogen chloride (gas), these values were calculated using spectral data; considering the corrections for inharmonious oscillations in H_2O, HDO, HCl, and DCl molecules and the corrections for the ratio of vapor elasticity of H_2O and HDO. The resulting values $\alpha_{0°} = 2.79$, $\alpha_{25°} = 2.45$, and $\alpha_{40°} = 2.32$ coincide with the tabulated experimental data. (R.V.J.)

3612

INVESTIGATIONS OF SnTe–GeTe SYSTEM. N. Kh. Abrikosov, A. M. Vasserman, and L. V. Poretskaya (Baikov Inst. Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 279-81(1958) Nov. 11. (In Russian)

Phase studies were made of the ternary system Ge–Sn–Ge along the cross section SnTe–GeTe. The phase diagram shows the liquidus and solidus line at a minimum near 80% GeTe and 700°. On the cross section between the two non-isostructural compounds SnTe and GeTe, the system forms a continuous series of solid solutions with a minimum on the melting diagram. The face-centered SnTe cubic lattice slowly transforms into a face-centered rhombohedral lattice of the GeTe compound. (R.V.J.)

3613

A STUDY OF GeO_2–Na_2O CONSTITUTION DIAGRAM. S. G. Tresvyatskii. Dopovidi Akad. Nauk Ukr. R.S.R. No. 3, 295-8(1958). (In Russian)

The constitution diagram of the GeO_2–Na_2O system was studied and a constitution diagram was constructed of the system for compositions containing from 100 to 35 mol % of GeO_2. (tr-auth)

3614

REACTION OF RHENIUM WITH METHYL VIOLET. A. T. Pilipenko and V. A. Obolonchik (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 6, 648-50(1958). (In Russian)

It is shown that rhenium in the form of perrhenate forms a complex with methyl violet, which may be extracted by benzol and toluol. The optimal pH value for the extraction is 3.5 to 5. The absorption spectrum of a solution of the perrhenate complex with methyl violet in toluol was studied. The solution of this complex proved to have three maxima: 330 mμ (ϵ = 229,500), 540 mμ (ϵ = 28,000), and 600 mμ (ϵ = 39,500). The sensitivity of the reaction to pure salts proved equal to 0.1 μg/ml of rhenium. The presence of a 40-fold quantity of molybdenum in respect to rhenium does not hinder the reaction. A large quantity of molybdenum lowers the sensitivity of the reaction. The color intensity of a toluol solution of the rhenium complex with methyl violet is proportional to the rhenium content and, therefore, the extracted complex of perrhenate with methyl violet may be applied for the colorimetric determination of rhenium. (tr-auth)

3515

ON THE INTERACTION OF THE CHLORIDES OF HAFNIUM, NIOBIUM AND TANTALUM WITH PHOSPHORUS CHLORIDE. B. A. Voitovich and I. A. Sheka (Inst. of Organic and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 8, 849-52(1958). (In Russian)

Studies were made of phase transformations in the systems $HfCl_4$–$POCl_3$, $NbCl_5$–$POCl_3$, $TaCl_5$–$POCl_3$, and of interactions of Hf, Nb, and Ta chlorides with phosphoryl chloride in nitrobenzene and benzene. The formation of $HfCl_4 \cdot 2POCl_3$, $HfCl_4 \cdot POCl_3$, $NbCl_5 \cdot POCl_3$, and $TaCl_5 \cdot POCl$ was confirmed and some errors in published data concerning the composition of hafnium and zirconium chloride compounds with phosphoryl chloride are pointed out. (tr-auth)

3616

PREPARATION AND PROPERTIES OF YTTRIUM HEXABORIDE. G. A. Kudintseva, M. D. Polyakova, G. V. Samsonov, and B. M. Tsarev (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 272-5(1958). (In Russian)

Descriptions are given of the thermo-vacuum method of YB_6 preparation in the reaction $Y_2O_3 + 3\ B_4C = 2YB_6 + 3CO$. The lattice period is a = 4.128 A (x-ray density 3.633 g/cm^3), and the pycnometric density is 3.64 ± 0.04 g/cm^3. The microhardness of YB_6 is 3264 ± 21 kg/mm^2 (at 50 g load) at melting temperature ~ 2300°C. Emission constants of YB_6 were found to be: the working yield 2.22 ± 0.05 ev and A = 15 a/cm^2 grad^2, and the emission coefficient $\epsilon_\lambda = 0.7$ at 1500°C. (R.V.J.)

3617

NUCLEAR MAGNETIC RESONANCE STUDIES FOR BORON TRIFLUORIDE COMPLEX FORMATION. P. Diehl (Univ. of Basel). Helv. Phys. Acta 31, 685-712 (1958). (In German)

Investigations of the displacement of the OH proton resonances as a function of the BF_3 concentration in BF_3-alcohol complexes show the existence of mono and dicomplexes. The structure for the dicomplex was confirmed. Between various BF_3 complexes an exchange of BF_3 groups occurs. The dependence of the exchange velocity on the BF_3 concentration and the temperature was investigated. For the exchange of BF_3 between BF_3CH_3OH and $BF_3C_2H_5OH$ an activation energy of 7.3 ± 1 kcal/mole was found. The chemical constituent of the H_2O-BF_3 system was identified as the molecules HBF_4, HBF_3OH, $HBF_2(OH)_2$, and $HBF(OH)_3$. Between these a F exchange occurs. Explicit relations were derived between the average duration time of a nucleus in a molecule which participates in a chemical exchange and the magnitudes such as amplitude, line width, and line displacement obtained from the spectrum. (tr-auth)

3618

PROPERTIES AND STRUCTURE OF $NiO-Al_2O_3$ CATALIZERS. I. EFFECTS OF COMPOSITION AND THERMAL TREATMENT CONDITIONS ON THE ACTIVITY AND SELECTIVE ACTION. A. M. Rubinshtein, A. A. Slinkin, and N. A. Pribytkova (Zelinskii Inst. of Organic Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk SSSR. Otdel. Khim. Nauk, 815-21(1958) July. (In Russian)

The optimum Al_2O_3-NiO catalyzer activity was found with the content of 5 to 15 mol % NiO. The selective action of the investigated catalyzers depends on the composition. Only dehydration takes place in a wide range of NiO concentrations, indicating the absence of free NiO. In coprecipitated $NiO-Al_2O_3$ catalyzers, the formation of $NiAl_2O_4$ spinel is possible at 400°. Variations in catalyzer specific surface magnitudes at 400 to 900° were also investigated. (R.V.J.)

3619

OXIDATION OF TITANIUM, ZIRCONIUM, AND HAFNIUM. G. R. Wallwork and A. E. Jenkins (New South Wales Univ. of Tech., Sydney). J. Electrochem. Soc. 106, 10-14(1959) Jan.

A metallographic study of the high-temperature oxidation of titanium, zirconium, and hafnium has shown that alterations in the rate equations relating to such processes may be associated with the establishment of oxygen diffusion gradients in the surface layers of the metal. It has been shown that these diffusion gradients in the metal extend in depth during an initial period in which the total rate of oxidation is given by the familiar parabolic equation. Subsequent changes in oxidation behavior have been related to observed alterations in the form of these gradients. (auth)

3620

THE ELECTRICAL RESISTANCE OF OXIDE FILMS ON ZIRCONIUM IN RELATION TO CORROSION. R. D. Misch and F. H. Gunzel, Jr. (Argonne National Lab., Lemont, Ill.). J. Electrochem. Soc. 106, No. 1, 15-20 (1959) Jan.

The conductivity of anodic and corrosion films on zirconium was found to increase during heating in vacuum. The conductivity changes at 450°C were studied on anodic films which were 0.6, 0.75, 0.9, and 1.5 μ in thickness. The change in conductivity was attributed to the diffusion of anion vacancies into the oxide with an estimated diffusion coefficient of 4×10^{-13} cm^2 sec^{-1}. Corrosion films produced in water at 350°C appeared to have higher diffusion coefficients. Among the materials zirconium, Zircaloy-1, and Zircaloy-2, specimens of zirconium had the highest corrosion rates and diffusivities (as judged by the conductivity changes). Consequently, an effect of vacuum heating on corrosion was expected and subsequently confirmed. Enhanced oxide growth was observed after corroded specimens were heated at 600°C for 1 min. The increase in weight gain was greater than would be expected from a simple restoration of dissolved oxide. (auth)

3621

VAPOR PRESSURE OF NIOBIUM. Rudolph Speiser (Ohio State Univ., Columbus), P. Blackburn (Westinghouse Electric Corp., Pittsburgh) and H. L. Johnston (H. L. Johnston Associates, Columbus, Ohio). J. Electrochem. Soc. 106, 52-3(1959) Jan.

The Langmuir method was used to determine the vapor pressure of niobium. An accommodation coefficient of unity was assumed. Least square treatment of the vapor pressure data yields the equation $\log P_{atm} = -(40{,}169)/T + 8.872$. The heat of sublimation at absolute zero, ΔH_0°, is 171.80 ± 0.49 and $\Delta H_{298.15}^\circ$ is 172.53 kcal/g atom. (auth)

3622

A SPECTROSCOPIC STUDY OF THE SORPTION OF METALLIC CATIONS BY OXIDIZED CELLULOSE. I. N. Ermolenko and R. G. Zhbankov. Kolloid. Zhur. 20, 429-35(1958) July-Aug. (In Russian)

The sorption of cations from dilute solutions containing UO_2^{2+}, Pb^{+2}, Cu^{2+}, Cd^{2+}, Ag^+, and Li^+ has been investigated by means of a previously developed infrared spectroscopic method. It was found that active sorption takes place also from dilute solutions, and in case of a mixture both cations are sorbed even if they differ considerably in their affinity for carboxyl groups. Changes in concentration do not affect the degree of sorption, indicating a high sorption energy. It has been established that contrary to cellulose and dialdehyde cellulose the sorption of UO_2^{2+}, Pb^{2+}, and Ca^{2+} on the carboxyl groups of oxidized cellulose is associated with considerable increase in absorption in the 7 to 8μ region, varying with the cation species. (tr-auth)

3623

APPARATUS FOR CONTINUOUS ANALYSIS OF ORTHO-PARA-HYDROGEN AND DEUTERIUM MIXTURE. D. I. Vasil'ev and A. I. Shal'nikov (Inst. of Problems in Physics, Academy of Sciences, USSR).

Pribory i Tekh. Ekspt. No. 4, 106(1958) July-Aug. (In Russian)

Descriptions are given of a sensitive thermal gas analyzer. The analyzer sensitivity in 1 mv for 1% para-hydrogen at block temperature −77.8°C (solid carbon dioxide) and total bridge current 180 ma. The sensitivity for 1% ortho-deuterium at the same current and −195°C (liquid nitrogen) is 1.44 mv, at 200 ma current it is 1.93 mv for 1% ortho-deuterium. (R.V.J.)

3624

ION-EXCHANGE EQUILIBRIA ON SINGLE BEADS. Erik Högfeldt (Brookhaven National Lab., Upton, N. Y.). Science 128, 1435-6(1958) Dec. 5.

Equilibria on single ion-exchange resin beads show that large differences may exist between beads from the same batch. They may be so large that a significant contribution to deviations from ideality can be due to this heterogeneity effect. Correlation between swelling and equilibrium properties shows that bead-to-bead variations are due to differences in cross-linking. (auth)

3625

TITRIMETRIC DETERMINATION OF SMALL AMOUNTS OF COBALT WITH AN EQUIVALENT RATIO OF 1 : 37. L. G. Bartha and S. Görög (Univ. of Szeged, Hungary). Talanta 1, 310-13(1958) Nov.

The nitrite content of the $KPb[Co(NO_2)_6]$ precipitate has been determined by reducing nitrite with excess of Fe^{II} salt. The excess of Fe^{II} or the Fe^{III} formed was then determined. With an equivalent ratio of 1 : 37 an exact method could thus be obtained for the titrimetric determination of small amounts of cobalt. (auth)

3626

TITRIMETRIC DETERMINATION OF ALUMINIUM WITH ETHYLENEDIAMINETETRA-ACETIC ACID IN THE PRESENCE OF IRON, COPPER, TITANIUM, MANGANESE, CALCIUM, MAGNESIUM, AND PHOSPHATE. Ch. Cimerman, A. Alon, and J. Mashall (Israel Inst. of Tech., Haifa and Israel Mining Industries Labs., Haifa). Talanta 1, 314-28(1958) Nov.

A rapid and accurate titrimetric method for the determination of 5—15 mg of aluminum with Complexone-III in the presence of iron, copper, titanium, manganese, calcium, magnesium, and phosphate was developed. (auth)

3627

THE SEPARATION AND DETERMINATION OF NIOBIUM AND TANTALUM BY PARTITION CHROMATOGRAPHY. Ian A. P. Scott and Robert J. Magee (Queen's Univ., Belfast). Talanta 1, 329-33(1958) Nov.

A procedure is outlined for the separation and determination of niobium and tantalum by paper chromatography. A mixture of methyl isobutyl ketone and hydrofluoric acid was used as solvent and the metals were detected by means of 8-hydroxyquinoline. The minimum amount of each element detectable is 20 μg. The procedure was applied successfully to the quantitative determination of small amounts of niobium and tantalum in a steel. (auth)

3628

GRAVIMETRIC DETERMINATION OF OSMIUM WITH 1 : 2 : 3-BENZOTRIAZOLE. Ray F. Wilson and Lawrence J. Baye (Texas Southern Univ., Houston). Talanta 1, 351-4(1958) Nov.

A method for the direct gravimetric determination of osmium with 1 : 2 : 3-benzotriazole in acetic acid-sodium acetate buffer is presented. The method is accurate and reproducible, and the conditions used in the determination are not critical. The precipitate is a stoichiometric compound which is stable from room temperature up to 200°. It appears that 1 : 2 : 3-benzotriazole is probably the first organic reagent to be used successfully in the direct gravimetric determination of osmium. (auth)

3629

DETERMINATION OF VANADIUM IN HIGH ALLOY STEELS BY ISOTOPE-DILUTION. G. Leliaret, J. Hoste, and J. Eeckhaut (Ghent Univ.). Talanta 1, 369-73(1958) Nov.

An isotope-dilution method has been developed for the determination of vanadium in high-alloy steels. Vanadium is titrated amperometrically after removal of chromium as chromyl chloride. Vanadium losses due to adsorption were corrected for radiometrically. The procedure was tested on N.B.S. steel samples and showed good precision and accuracy. (auth)

3630

THE QUANTITATIVE DETERMINATION OF FISSION AND NUCLEAR REACTION PRODUCTS. C. E. Crouthamel, Robert Heinrich, and Christopher Gatrousis (Argonne National Lab., Lemont, Ill.). Talanta 1, 396-407(1958) Nov.

Definitions are given to the terms "per cent atom burn-up" and "per cent atoms consumed" as applied to nuclear fuel analysis at the Argonne National Laboratory. The radiochemical and analytical methods which have been adapted and developed especially for this type of analysis are discussed. The analysis of nuclear reaction products by paper chromatographic methods and scintillation spectrometry is emphasized and demonstrated. (auth)

3631

GERMANIUM AND ITS COMPOUNDS. (GERMANIDES AND GERMANATES). Kh. Novotnyi. Uspekhi Khim. 27, 996-1009(1958) Aug. (In Russian)

A review is presented of germanides (in binary and multicomponent systems) and germanates. The structure and properties are studied from the point of view of structural chemistry, based on comparisons with corresponding silicides and silicates. These phases show great similarity; ThGe has a B1 structure and Th_3Ge_2 and β-$ThGe_2$ are isostructural with the similar silicides. Three structures, T1, T2, and $D8_8$, of Me_5Si_3 phases were observed in Ta germanides. The structural similarity is less pronounced in germanates. Pentagermanite ion exists in the aqueous solution GeO_2 or in germanic acid, but it is never found in the compounds which are customarily called pentagermanates. The existence of acid germanates with ideal formula $Me_3HGe_7O_{16} \cdot H_2O$ and the formation of acid salts SrH_2GeO_4 (of KH_2PO_4 type), $Na_2H_2GeO_4 \cdot 6H_2O$, and $BaH_2GeO_4 \cdot 4H_2O$ was confirmed. (R.V.J.)

3632

THERMODYNAMIC PROPERTIES OF ALKALINE EARTH METALS (Mg, Ca, Sr AND Ba) AND OF THEIR OXIDES AND MONOHYDRIDES IN THE GASEOUS STATE. I. V. Veitz, L. V. Gurvich, and N. P. Rtishcheva (Inst. of Mineral Fuel, Moscow). Zhur. Fiz. Khim. 32, 2532-42(1958) Nov. (In Russian)

The thermodynamic functions of alkaline earth metals and of their oxides and monohydrides were computed by the methods of statistical thermodynamics for the ideal gaseous state. Account was made of the excited electronic states of atoms and molecules and the method of Gorden and Barnes was used for calculating the thermo-

dynamic functions of diatomic gases. The values for the free energy functions $\Phi_T^* = -F_T^0 - H_{O_2}/T$ the entropy, S_T°, the enthalpy $H_T^\circ - H^0$ and of the logarithm of the dissociation equilibrium constant, lg k_p, were tabulated for temperatures ranging from 293.16 to 3500°K. (tr-auth)

3633

PREPARATIONS AND PROPERTIES OF HEXAVALENT PLUTONIUM OXALATE COMPLEXES. A. D. Gel'man and L. E. Drabkina. Zhur. Neorg. Khim. 3, 1105-8 (1958) May. (In Russian)

A solution of plutonyl oxalate was prepared and the formula determined as $PuO_2C_2O_4 \cdot 3H_2O$. The solubility of plutonium oxalate in nitric acid (0.5 to 3N) in the presence of oxalic acid and ammonium oxalate was determined. The formula for simple complex plutonium, obtained in plutonium oxalate solution in aluminum oxalate, is written as $(NH_4)_2(PuO_2(C_2O_4)_2)$. (R.V.J.)

3634

PREPARATION AND PROPERTIES OF SOME CARBONATE COMPOUNDS OF HEXAVALENT PLUTONIUM. L. E. Drabkina (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 1109-10 (1958) May. (In Russian)

Solid solutions of ammonium plutonyl carbonate were obtained and the formula $(NH_4)_4(PuO_2(CO_3)_3)$ determined. It is shown that ammonium plutonyl carbonate dissociates at 120 to 130°C to monocarbonate PuO_2CO_3. (R.V.J.)

3635

OXALATE COMPLEX COMPOUNDS OF PLUTONIUM (IV). A. D. Gel'man and L. P. Sokhina. Zhur. Neorg. Khim. 3, 1100-4(1958) May. (In Russian)

Solid-phase compounds of plutonium(IV) complexes, $Na_4(Pu(C_2O_4)_4) \cdot 5H_2O$, $K_4(Pu(C_2O_4)_4) \cdot 4H_2O$, $K_6(Pu(C_2O_4)_5) \cdot 4H_2O$, $(NH_4)_6(Pu(C_2O_4)_5) \cdot nH_2O$ were prepared and analyzed. The structures of the complexes were confirmed by molecular electroconductivity determination and molecular weight. It is shown that complex compounds $(K, Na)_4(Pu(C_2O_4)_4) \cdot 4H_2O$ can exist in two modifications as red crystals and green-yellow crystals. Oxalate complex compounds of Pu(IV) are stable in cold or heated aqueous solutions. Alkalization or acidification of the solution causes hydration or dissociation of the complex into component parts. (R.V.J.)

3636

ON THE SIMILARITY IN THE CHEMICAL NATURE OF ACTINIDES. E. S. Makarov (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 1079-88(1958) May. (In Russian)

The actinide and thorium hypotheses are reviewed, and isostructural complexes of actinides, lanthanides, and IVa, Va, and VIa elements are analyzed. The "isomorphous analysis" serves as an additional crystallo-chemical and physico-chemical confirmation of the chemical similarity of actinide elements (especially thorium and uranium) to IVa, Va, VIa elements. The chemical similarities between the actinides and IVa, Va, and VIa elements and the similarity with lanthanides indicate the chemical similarity of actinides. (R.V.J.)

3637

CESIUM AND CHROMIUM FLUOMANGANATES. I. G. Ryss and B. S. Vitukhnovskaya. Zhur. Neorg. Khim. 3, 1185-7(1958) May. (In Russian)

The pentafluomanganate of cesium $Cs_3MnF_5 \cdot H_2O$ was synthesized and found to be similar in composition and properties to the potassium salt. The difficultly soluble and chemically stable fluomanganate of chromium, $MnF_3CrF_3 \cdot 6H_2O$, was also synthesized. The suggested structure is $(CrF_2(H_2O)_4)(MnF_4(H_2O)_2)$ or $(CrF(H_2O)_5)(MnF_5H_2O)$. (R.V.J.)

3638

NIOBIUM SEPARATION FROM TITANIUM BY ION EXCHANGE. O. V. Al'tshuler, E. A. Subbotina, and A. F. Afanas'eva. Zhur. Neorg. Khim. 3, 1192-9(1958) May. (In Russian)

An attempt was made to find suitable chromatographic conditions for recovering large quantities of niobium. Niobium and titanium were separated as complex anions. Data on the equilibrium and kinetics of niobium and titanium ion exchange in chloride solutions indicate the existence of several types of complex ions, the composition of which can be determined with concentrations of HCl. The separation is complicated by the formation of complex ions containing both elements. Studies were also made of the behavior of tantalum and iron which are often present as impurities in niobium. (R.V.J.)

3639

PREPARATION OF LEAD METATITANATE MONOCRYSTALS FROM $PbO-B_2O_3-TiO_2$ MELTS. M. L. Sholokhovich. Zhur. Neorg. Khim. 3, 1214-19(1958) May. (In Russian)

The surface of $PbO-B_2O_3-TiO_2$ melt crystallizations and the properties of $PbTiO_3$ monocrystals were studied. Crystals of lead metatitanates were prepared by cooling $PbO-TiO_2-B_2O_3$ melts. The most efficient component concentrations for the preparation of large crystals were found to be 80%(50% PbO + 50% B_2O_3) + 20% $PbTiO_3$ and 60%(50% PbO + 50% B_2O_3) + 40%(75% PbO + 25% TiO_2). (R.V.J.)

3640

STUDIES OF EQUILIBRIUM IN ZrO_2 AND V_2O_2 CARBON REDUCTION REACTIONS AT HIGH TEMPERATURE. V. I. Zhelankin, V. S. Kutsev, and B. F. Ormont (All Union Research Inst. of Alloys). Zhur. Neorg. Khim. 3, 1237-40(1958) May. (In Russian)

The multivariant equilibrium in the ZrC_xO_y-C-CO and VC_xO_y-C-CO systems with constant gas pressure, CO = 760 mm mercury, in the temperature range 1900 to 2500°C was studied in order to determine the dependence of the oxycarbide phase composition dependence on temperature. (R.V.J.)

3641

ACID RESISTANCE OF MOLYBDENUM SILICIDES. T. Ya. Kosolapova and E. E. Kotlyar. Zhur. Neorg. Khim. 3, 1241-4(1958) May. (In Russian)

Effects of acids and acid mixtures on $MoSi_2$, Mo_3Si_2, and Mo_4CSi_3 were studied in order to find data for further chemical investigations of Mo-Si alloy phases. (R.V.J.)

3642

APPLICATIONS OF LUMINESCENCE IN STUDIES OF ZINC OXIDE AND BORON ANHYDRIDE REACTIONS. Yu. S. Leonov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 1245-53(1958) May. (In Russian)

The constitution diagram of the $ZnO-B_2O_3$ was corrected, and it was found that two compounds ($ZnO \cdot B_2O_3$ and 3 $ZnO \cdot B_2O_3$) are formed in the system. Debye diagrams were plotted, and characteristic interplane

distances were found. In the presence of manganese traces the compound $ZnO \cdot B_2O_3$ possesses green luminescence and green temperature luminosity while 3 $ZnO \cdot B_2O_3$ has an orange luminescence with orange post luminosity. Application is made of the luminescence in studies of the solid phase reactions in $ZnO \cdot B_2O_3$. (R.V.J.)

3643

ON IRON MOLYBDATES. Yu. D. Kozmanov and T. A. Ugol'nikova. Zhur. Neorg. Khim. 3, 1267(1958) May. (In Russian)

Three iron molybdates were synthesized: the α phase ($FeMoO_4$), β phase (Fe_2MoO_4), and γ phase ($Fe_2(MoO_4)_3$). On sintering the FeO and MoO_2 at 700 to 800°C in iron containers in argon, another phase of iron molybdate was observed which could not be determined. (R.V.J.)

3644

PREPARATIONS OF ALKALI EARTH METAL BORIDES BY CARBO-THERMAL METHOD. L. Ya. Markovskii and N. V. Vekshina (State Inst. of Applied Chemistry). Zhur. Priklad. Khim. 31, 1293-9(1958) Sept. (In Russian)

Preparations of alkali metal borides by the reaction $MeO + 3B_2O_2 + 10C \rightarrow MeB_6 + 10CO$ were complicated by interfering side processes. Three variations developed for carbon purification of borides gave satisfactory results for calcium borides and strontium borides, but were unsatisfactory in the preparation of barium borides due to large concentrations of solid solutions of carbon. Preparations of ZrB and TiB_2 by the carbothermal method showed good results without additional purification from carbon. (R.V.J.)

3645

PREPARATIONS OF LANTHANUM CARBIDES. M. S. Koval'chenko, V. S. Neshpor, and G. V. Samsonov. Zhur. Priklad. Khim. 31, 1427-9(1958) Sept. (In Russian)

Preparations of lanthanum carbide are obtained by the reduction of lanthanum oxide in a graphite-stack furnace at 900 to 2000° for 1 to 2 hours ($La_2O_3 + 7C = 2LaC_2 + 3CO$). Lanthanum carbide begins to form at 1700°, however, the most favorable temperature for carbide production is 1850° for 2 hrs. Results of experiments made between 1100 and 1950°C are tabulated. (R.V.J.)

3646

SYMPOSIUM ON SPECTROCHEMICAL ANALYSIS FOR TRACE ELEMENTS. ASTM Special Technical Publication No. 221. Presented at the Sixtieth Annual Meeting, American Society for Testing Materials, Atlantic City, N. J., June 18, 1957. Philadelphia, American Society for Testing Materials, 1958. 81p. $2.75.

A symposium on spectrochemical analysis of trace elements included reports on spectrographic determination of trace elements in metals, trace analysis by means of the graphite spark, principles of quantitative biological emission spectrography, applications of emission spectroscopy to trace element analysis in plant and soil samples, and spectrochemical analyses of trace elements in geological materials. Separate abstracts have been prepared for each paper. (J.E.D.)

3647

SPECTROGRAPHIC DETERMINATION OF TRACE ELEMENTS IN METALS. J. A. Norris (Oak Ridge National Lab., Tenn.). pp.23-38 in "Symposium on Spectrochemical Analysis for Trace Elements."

In many examples reported it is possible to determine less than 1-ppm quantities of impurities present by conventional metal excitation or simple conversion to salt form. Where the element to be determined does not have the inherent sensitivity to attain the desired analytical limit, more complicated methods must be used. Each method, whether direct or indirect, has its advantages and disadvantages and no absolute method is proposed to solve all problems. Further advances in the other nonmetallic areas can be expected to assist greatly in solving those problems that are actually common to all fields of analytical spectroscopy. (auth)

3648

TRACE ANALYSIS BY MEANS OF THE GRAPHITE SPARK. James M. Morris and Francis X. Pink (Metal Hydrides, Inc., Beverly, Mass.). pp. 39-46 in "Symposium on Spectrochemical Analysis for Trace Elements."

A combined method for the determination of trace elements is described. Chemical separation and concentration of the impurities is followed with spectrographic analysis by means of the graphite spark. The method based on synthetic standards has been applied successfully to the determination of parts per billion quantities in semi-conductor materials. An outline of the chemical concentrational procedures is given. The spectrographic techniques of the graphite spark method are described and the excitation conditions, the line pairs, and the sensitivities are listed. (auth)

3649

PRINCIPLES OF QUANTITATIVE BIOLOGICAL EMISSION SPECTROGRAPHY. Bert L. Vallee (Peter Bent Brigham Hospital and Harvard Medical School, Boston). pp. 47-57 in "Symposium on Spectrochemical Analysis for Trace Elements."

Spectrochemical techniques have opened new fields of cell and protein study. The applications of these techniques, equipment required, and the necessary training for competent investigators are briefly discussed. (D.E.B.)

3650

APPLICATIONS OF EMISSION SPECTROSCOPY TO TRACE ELEMENT ANALYSIS IN PLANT AND SOIL SAMPLES. W. G. Schrenk (Kansas Agricultural Experiment Station, Manhattan). pp. 58-66 in "Symposium on Spectrochemical Analysis for Trace Elements."

Spectrographic procedures used in agricultural research are described. Included is a discussion of the approach used to design satisfactory analytical procedures and a description of some of the problems in which these methods have been used. (auth)

3651

SPECTROCHEMICAL ANALYSIS FOR TRACE ELEMENTS IN GEOLOGICAL MATERIALS. K. J. Murata (U. S. Geological Survey, Washington). pp. 67-79 in "Symposium on Spectrochemical Analysis for Trace Elements."

Because 99% of the earth's crust consists of only ten elements, all with atomic numbers smaller than 27, the vast majority of the elements are trace constituents of the crust. Semiquantitative and quantitative spectrochemical methods are being used extensively in basic geochemical studies on the distribution of the elements in crystal rocks, in systematic exploration for hidden ore deposits, and in determination of by-product elements in ores. Trace analysis of natural crystals is of interest with respect to structure-sensitive properties such as color and fluorescence. Trace elements in river and ocean waters constitute a challenging subject for research. (auth)

3652
FINE PARTICLE MEASUREMENT. SIZE, SURFACE, AND PORE VOLUME. Clyde Orr, Jr. and J. M. Dallavalle. New York, The MacMillan Company, 1959. 364p.

The first chapter discusses the significance of measurement techniques and their selection. The next four chapters present methods for determining particle size by microscopy and sieving, sedimentation, inertial techniques, and radiation scattering and transmission. Other chapters describe methods of measuring the surface area of particles by permeametry, gas adsorption, liquid-phase sorption, and pore size and pore-size distribution. (W.L.H.)

Radiation and Radiochemistry

Refer also to abstract 4374.

3653 AECU-3932
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RADIATION CHEMISTRY OF ORGANIC SUBSTANCES. Annual Report No. 1 [for] January 1, 1957 to December 31, 1957. Raymond G. Wymer. Mar. 31, 1958. 48p. For Oak Ridge National Lab. Project No. A-323. Contract W-7405-eng-26, Subcontract No. 1082. $9.30(ph OTS); $3.60(mf OTS).

Work is reported on solvent radiation damage and permissible irradiation levels for solvents used in processing power reactor fuels. Amsco 125-82 was selected for use in the initial studies. It is a diluent typical of the types commonly used for extractants employed in fuel processing and raw material processing. It has also been used as a heat exchange fluid in equipment exposed to high radiation fields. Amsco 125-82 was fractionated into its pure components so that these components could be investigated individually. (W.L.H.)

3654 AECU-3941
Michigan State Univ., East Lansing.
BULK PROPERTIES OF STABLE ISOTOPES AS A PROBE FOR LIQUID-STATE AND SOLID-STATE INVESTIGATIONS. D. J. Montgomery. [1958]. 20p. $3.30(ph OTS); $2.40(mf OTS).

This report supersedes A/CONF.15/P/695.

Studies of the effects of isotopic mass on the physical properties of matter are described in which measurements are made on bulk quantities of lithium of only one isotope. The quantities investigated were lattice constant, bulk density, electric conductivity, thermoelectric force, and melting point. Some studies on lithium compounds are discussed also. (T.R.H.)

3655 AERE-C/M-366
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ISOTOPIC ANALYSIS OF AMERICIUM AND CURIUM BY MASS SPECTROMETER. D. F. Dance. Nov. 1958. 5p.

Isotopic analyses of americium and curium were carried out by mass spectrometer using about 10^{-6} g and 10^{-9} g of these elements, respectively. While satisfactory measurements of the main isotopic abundances were made, abundances of the order of 2% were measured with an accuracy of only ± 10%, due to the small quantity of sample used. (auth)

3656 AERE-MED/R-2720
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
PREPARATION OF LANTHANUM NITRATE OF LOW ALPHA-ACTIVITY. J. E. Marriot. Oct. 1958. 7p. $0.25(BIS).

A method is given to reduce the alpha activity of lanthanum nitrate, intended for possible use in urine analysis as a coprecipitant, to a tolerable level. (auth)

3657 NP-7078
Princeton Univ., N. J. Frick Chemical Lab.
OXIDATIVE STRESS RELAXATION OF RADIATION CROSS-LINKED NATURAL RUBBER. A. V. Tobolsky and A. Mercurio. Project NR-356-377. Contract Nonr-1858(07). (ONR-TR-RLT-25).

Evidence is presented which shows that oxidative scission at elevated temperatures is independent of the degree of cross-linking in radiation cross-linked natural rubber as studied by stress relaxation. The rate of scission in these vulcanizates is the same within 50% as the rate of scission determined for unvulcanized rubber. These results demonstrate that scission in the vulcanizates occurs randomly along polyisoprene chains, not specifically at the cross-linked sites. (auth)

3658 NP-7105
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
PREPARATION OF ^{32}P-LABELLED BARIUM DIHYDROGEN HYPOPHOSPHATE, PHOSPHORUS TRICHLORIDE, AND ORTHOPHOSPHOROUS ACID. Report No. 40/V. A. Siuda. Nov. 1958. 7p.

A procedure is given for the preparation of barium dihydrogen hypophosphate ($BaH_2P_2^{32}O_6 \cdot 2H_2O$), phosphorus trichloride ($P^{32}Cl_3$), and orthophosphorous acid ($H_3P^{32}O_3$). (W.L.H.)

3659 AEC-tr-3490
EXTRACTION METHOD FOR THE SEPARATION OF TECHNETIUM FROM IRRADIATED MOLYBDENUM. M. S. Faddeeva (Faddeev), O. N. Palov, and V. V. Bakunina. Translated for Oak Ridge National Lab. from Zhur. Neorg. Khim. 3, 165-6(1958). 4p.

The extraction of technetium from irradiated molybdenum using methyl-ethyl ketone is examined. The distribution coefficient of Tc between K_2CO_3 solution and methyl-ethyl ketone is much larger than is the case when pure water is used with the ketone. Molybdenum has the same salting-out effect; however, an increase in the K_2CO_3 concentration in the presence of large amounts of molybdenum in solution decreases the distribution coefficient for Tc. These considerations were applied in obtaining the 6-hour Tc^{99m} isomer. Methods of Tc identification and separation efficiency are discussed, and it is concluded that about 1 mg of Tc can be separated with a calculated purity of about 75 to 80%. (J.R.D.)

3660 CEA-tr-A472
IDENTIFICATION DE PRODUITS DE FISSION DE L'URANIUM PAR CHROMATOGRAPHIE SUR PAPIER. (Identification of Uranium Fission Products by Paper Chromatography.) H. Götte and D. Pätze. Translated by A. Ritter from Angew. Chem. 69, 608-14(1957). 29p.

It has been shown that artificial mixtures of uranium fission products can be separated by paper chromatography. In the present work, a simple method of detecting qualitatively the principal elements of a true mixture of uranium fission products is presented. The

elements must have a period of over 5 hr. The tests were made on uranium samples which had been irradiated in a reactor from 6 days to 3 months. (tr-auth)

3661 CEA-tr-R196

ECHANGE ISOTOPIQUE DES ATOMES DE SOUFRE DES SUBSTANCES ACCÉLÉRANT LA VULCANISATION EN PRÉSENCE DE DIPHENYL β NAPHTHYLAMINE. (Isotopic Exchange of Sulfur Atoms of Vulcanization Accelerators in the Presence of Diphenyl β Naphthylamine.) G. A. Bloch, E. A. Goloubkova, and K. V. Kourskaia. Translated by M. Lutynsky from Doklady Akad. Nauk S.S.S.R. 105, 275-8(1955). 8p.

The kinetics of isotopic exchange of S among the materials in rubber was studied. Mixtures of these components (accelerators and amine derivatives) with radioactive S were sealed in tubes and heated to 100 and 125°C for varying periods of time, then analyzed for radioactive S. The results are discussed with relation to mechanisms of the processes involved in vulcanization of rubber. (T.R.H.)

3662 CEA-tr-R227

ETUDE DE L'ÉLECTRODE DE VERRE PAR LA MÉTHODE DES INDICATEURS RADIOACTIFS. II. COMPORTEMENT DE L'ÉLECTRODE DE VERRE DANS LA RÉGION ALCALINE. (Study of the Glass Electrode by the Method of Radioactive Indicators. II. Behavior of the Glass Electrode in the Alkaline Region.) N. A. Izmailov and A. G. Vassiliev. Translated by M. Schkaff from Zhur. Fiz. Khim. 30, 1500-12 (1956). 28p.

Radioactive indicators were used to study adsorption in the alkaline region of Na, K, Cs, Ca, and Br ions on glass electrodes and glass plates with electrodes. In neutral or alkaline solution a cation adsorption is observed which increases with pH and cation concentration. In the pH—adsorption relation an inconstancy of the ion exchange constant on glass is observed, the constant increasing with passage from alkaline to acid. No adsorption of Br^- was found in neutral or alkaline solution, showing that the mechanism of adsorption is ion exchange. The order of adsorbability of monovalent cations is the same as for increasing ionic radius: Na > K > Cs. The number of ions adsorbed on the glass increases with time and approaches saturation very slowly. Calculations show that the layer of glass participating in the reaction is of the order of thousands of angstroms. The desorption is very slow. (T.R.H.)

3663 CEA-tr-R500

NATURE DU PRODUIT INSOLUBLE FORMÉ LORS DE L'OXYDATION RADIOLYTIQUE DU BENZÈNE DANS L'EAU. (Nature of the Insoluble Product Formed During the Radiolytic Oxidation of Benzene in Water.) E. V. Barelko, L. I. Kartacheva, and M. A. Proskournine. Translated from Doklady Akad. Nauk S.S.S.R. 116, 74-7(1957). 8p.

The white suspension which is formed during the irradiation of benzene in water was studied. The suspension was separated from the solution, its molecular weight was determined by cryoscopy, the elementary composition was determined by combustion analysis, the spectrum of alcohol solutions in the ultraviolet was studied, and a colorimetric analysis of its solutions was made. The results showed that the weight of the suspension increases linearly with the irradiation dose. The spectrum has a maximum at λ = 250 to 255 mμ. The elementary analysis gave C = 74.4%, O = 16%, and H = 7 to 8%. The molecular weight was 183 ± 3. The results led to the conclusion that the suspension is probably a dioxide derivative of diphenol. The probable reaction mechanism for the radiolytic oxidation of benzene in water solutions is discussed. (J.S.R.)

3664 CEA-tr-X69

ETUDE SUR LA SÉPARATION DES PRODUITS DE FISSION PAR LA MÉTHODE DE DISTILLATION (1 ER RAPPORT)—MÉTHODE DE DISTILLATION DU RUTHENIUM (1 ERE PARTIE). (Study on the Separation of Fission Products by the Distillation Method. I. Method for the Distillation of Ruthenium.) T. Kambara. Translated by S. S. Minn from Bunseki Kagaku 5, 222-4(1956). 12p.

As a method for the distillation after oxidation of carrier-free ruthenium from fission products, the use of potassium bichromate in a solution acidified with sulfuric acid was studied. The apparatus used is described. The results showed that the yield of ruthenium is a maximum for a sulfuric acid concentration of 44% in a total volume of 40 cm^3 and for a potassium bichromate quantity of approximately 1.0 g. A comparison of this method with the utilization of potassium permanganate shows that the yield is of the same order, but the final point of distillation was clearer using the bichromate and the distillation time was shorter, being only 2 to 3 min. Also the concentration of sulfuric ions in the distillate from the bichromate method was less. The temperature of distillation of carrier-free ruthenium was found to be in the vicinity of that of water. The ruthenium distills in the form of the tetraoxide. A second distillation on a sample which had reached the final distillation point resulted in the recovery of a considerable quantity of ruthenium. (tr-auth)

3665 CEA-tr-X92

SÉPARATION DES PRODUITS DE FISSION PAR DES RÉSINES ÉCHANGEUSES D'IONS. (Separation of Fission Products by Ion Exchange Resins.) M. Honda, Y. Sasaki, and H. Natsume. Translated by Eiichi Hara from Bunseki Kagaku 4, 240-2(1955). 7p.

The ion exchange separation of fission products was studied. The classical method of ion exchange was modified only a little. Satisfactory results were obtained by using an ammonium chloride solution for the separation of the alkaline metals, an ammonium acetate solution for the separation of the rare earths, and EDTA for the separation of the alkaline earth metals. (J.S.R.)

3666

NEW RAPID AND ACCURATE METHOD OF GRAVIMETRIC URANIUM DETERMINATION. Nascutiu Tiberiu (Academy of Sciences of Rumania). Comun. acad. rep. populare Romine 7, No. 1, 51-6(1957). (Translated from Referat. Zhur. Khim. No. 6, 1958, Abstract No. 17561.)

A rapid and accurate gravimetric method for the determination of uranium is presented. Excess ammonium carbonate is added to a uranyl solution. The addition of ammonium cobalt nitrate precipitates a stable insoluble yellow-orange uranium compound, which can be filtered, dried, and weighed to give the uranium contents. The determination takes 40 to 45 min with a relative error of ±0.7%. (J.S.R.)

3667

ON THE RADIOLYSIS OF HEPTANE. A. M. Brodskii, Yu. A. Kolbanovskii, E. D. Filatova, and A. S. Chernysheva (Inst. of Oil, Academy of Sciences, USSR).

Doklady Akad. Nauk SSR 122, 1035-8(1958) Oct. 21. (In Russian)

The γ radiolysis of normal heptane in the liquid phase and radiolysis of dibenzylsulfide solution in heptane were studied. The exact kinetics of radiolysis in the initial sections, the influence of break-downs in the irradiation, and the composition and yield of the gas in the wide range of doses were determined. (R.V.J.)

3668

AN INVESTIGATION OF ELECTRON-PARAMAGNETIC RESONANCE SPECTRA OF SOME POLYMERS IRRADIATED AT 77°K. Yu. D. Tsvetkov, N. N. Bubnov, M. A. Makulskii, et al. (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk SSR 122, 1053-6(1958) Oct. 21. (In Russian)

Some problems related to the structure and chemical behavior of organic radicals in the solid phase and the mechanisms of chemical transformation occurring in solid organic bodies under the action of penetrating irradiation were studied, using the method of electron paramagnetic resonance of the free radicals formed in irradiation of a series of polymers and related materials. Tests were made with polyethylene, polyvinyl chloride, teflons, polydimethylsiloxane, polyisobutylene, polymethyl methacrylate, polystyrol, polybutyl methacrylate, and natural rubber. (R.V.J.)

3669

EFFECT OF PHYSICAL STATE DURING THE ELECTRON IRRADIATION OF HYDROCARBON POLYMERS. PART I. THE INFLUENCE OF PHYSICAL STATE ON REACTIONS OCCURRING IN POLYETHYLENE DURING AND FOLLOWING IRRADIATION. Elliott J. Lawton, J. S. Balwit, and R. S. Powell (General Electric Co., Schenectady, N. Y.). J. Polymer Sci. 32, 257-75(1958) Nov.

Studies were made on the effect of physical state on the efficiency of the crosslinking reactions occurring in polyethylene during and following irradiation. Particular consideration was given to the influence of crystallinity during irradiation. Samples of low- and high-density polyethylene were irradiated at various temperatures in a nitrogen atmosphere with electrons of 800 kv energy from a GE resonant transformer type of electron generator. Discussions are included on gel formation vs. irradiation dose and the equivalent D_{150} dose, the effect of temperature on crosslinking, the effect of physical state on trans-vinylene formation, trapped radicals in the crystalline regions, the amount of delayed crosslinking, the effect of physical state on hydrogen evaluation, material balance, and the effect of vinyl unsaturation. (J.H.M.)

3670

EFFECT OF PHYSICAL STATE DURING THE ELECTRON IRRADIATION OF HYDROCARBON POLYMERS. PART II. ADDITIONAL EXPERIMENTS AND DISCUSSION PERTAINING TO TRAPPED RADICALS IN HYDROCARBON POLYMERS. Elliott J. Lawton, R. S. Powell, and J. S. Balwit (General Electric Co., Schenectady, N. Y.). J. Polymer Sci. 32, 277-90(1958) Nov.

Observations were made of trapped radicals in low- and high-density polyethylene following irradiation. Methods of detecting trapped radicals, sample preparation, and irradiation procedures are described. Discussions are included on the conditions for trapping radicals at room temperature, trapped radical decay, radical decay in low-density vs. high-density polyethylene, reactions on storage in oxygen, delayed main chain scissions, and the physical properties of irradiated high-density polyethylene. (J.H.M.)

3671

PRODUCTION OF COMPOUNDS LABELLED WITH CARBON-14 FROM CARBON-14 DIOXIDE ACCELERATED IN AN ELECTRIC FIELD. M. Guillaume (Univ. of Liege). Nature 182, 1592(1958) Dec. 6.

A procedure is described for the preparation of organic compounds labeled with carbon-14 based on the acceleration of carbon-14 dioxide by submitting it to a voltage of 500 volts. Under such conditions, carbon-14 reacts with organic compounds or radicals. Labeled organic molecules prepared by this method include acetamide, citric acid, succinic acid, benzoic acid, and benzoates. A diagrammatic drawing of the apparatus is included. (C.H.)

3672

THE ACTION OF γ-RAYS ON SODIUM DEOXYRIBONUCLEATE IN SOLUTION. R. A. Cox, W. G. Overend, A. R. Peacocke, and S. Wilson (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) B149, 511-33(1958) Dec. 24.

The effect of irradiation by γ rays from a cobalt-60 source, without exclusion of oxygen, on the molecular structure of herring sperm sodium desoxyribonucleate (DNA) has been studied with the following aims: (1) to obtain evidence on the existence of the double-helical DNA structure in aqueous solution by testing the application of recent theoretical treatments for the random fracture of single-chain macromolecules; and (2) to study the effects of dosages of γ rays lower than those which have been shown to disrupt the constituent nucleotides. Changes in viscosity, electrometric titration behavior, ultra-violet absorption, precipitability, and other chemical properties were investigated. The viscosity of solutions of DNA in 0.1 M sodium chloride was decreased on irradiation by an amount which was independent of the dose rate and was determined by the ratio (R, in ev/atom of DNA phosphorus) of dosage in ev entering each ml of solution to concentration of DNA phosphorus. The reduced specific viscosity of irradiated DNA solutions was a linear function of concentration and obeyed the Huggins equation. The intrinsic viscosity $[\eta]$ decreased with increasing R and, on a logarithmic plot, the relation was linear with a negative slope of 1.9 at the higher R values. Comparison of this value with that expected from the theory of random degradation leads to the proposal that a decrease in molecular weight, and thus in $[\eta]$, of the DNA can occur only when two independent breaks occur at approximately opposite positions in each of two intertwined polynucleotide chains; this indicates that the double-helical structure adduced for the moist solid state persists in aqueous solution. This is confirmed by the observation that a DNA preparation which had undergone mild acid treatment before irradiation, in order to disrupt the complementary cross-linking hydrogen bonds and thereby the double-helical structure, exhibited a less steep decrease of $[\eta]$ with increasing R (i.e. a slope of -1.2 on the logarithmic plot). The earlier theory for the viscosity of a single-chain macromolecule undergoing random breakdown is extended to the case of degradation of a cross-linked molecule consisting of two intertwined chains. The difference between the forward- and backward-titration curves characteristic of the hydrogen-bonded DNA structure decreased on γ irradiation, which indicates a progressive disruption of the complementary hydrogen bonds and of the double-helical structure that

they hold together; this was confirmed by observed parallel increases in ultra-violet absorption. The asymmetrical character of the displacement suggests, though not quite conclusively, that the hydrogen bonds linking adenine and thymine were ruptured more readily than those joining guanine and cytosine. The combined rupture of all hydrogen bonds had initially a very high G value, of the order of sixty base pairs severed per 100 ev, but this decreased with increasing dosage. This efficient rupture of complementary hydrogen bonds would presumably impair the duplication of the DNA helices in vivo and may underlie some of the biological effects of low dosages of ionizing radiation. The titration studies demonstrated the release at high R of approximately equal quantities of acidic groups with pK_a^1 of about 4.5 to 5.5 and of 5.5 to 8.5; this observation is discussed briefly in connection with the detailed chemical mechanism of the rupture of phospho-ester linkages. The indirect nature of the action of γ rays under the present conditions was confirmed by the determinative character of the ratio R and by the inhibitory effects of certain compounds known to combine with the free radicals produced in the water. (auth)

3673

NEUTRON ACTIVATION ANALYSIS. Robert Druyan, T. G. Mitchell, E. R. King, and R. P. Spencer (U. S. Naval Hospital, Bethesda, Md.). Radiology 71, 856-9 (1958) Dec.

A discussion of the principles, techniques, and limitations of neutron activation analysis, as applied to biological material, is presented. The difficulties of isotopic discrimination by means of gamma analysis are discussed, with particular reference to the problem of Na^{24}. Preliminary results with regard to analysis are mentioned. (auth)

3674

THE CATALYTIC POLAROGRAPHIC REDUCTION OF OXALIC ACID IN THE PRESENCE OF URANYL SALTS. Zbigniew Ryszard Grabowski and Anna Grabowska. Roczniki Chem. 30, No. 4, 1245-57(1956). (Translated from Referat. Zhur. Khim. No. 6, 1958, Abstract No. 17225.)

In solutions with pH 2 in the presence of UO_2^{2+} ions (I) ($\sim 10^{-4}$ M) oxalic acid (II) gives rise to a new polarographic wave at about −1.3 volts (saturated calomel electrode). It corresponds to a two-electron reduction process of II (probably into glyoxalic acid). In the case of very small I concentrations (750 times smaller than the excess of II) the limiting current is smaller than the diffusion current, and is determined by the kinetics of the chemical reaction. It is established that $U(C_2O_4)_2$ complexes are subject to an irreversible reduction, and an empirical equation describing the kinetics of the process is given. The wave described can be used in determining I in the 10^{-4} to 10^{-2} M concentration interval with a precision of ~4.5%.

3675

PROBLEMS IN RADIATION CHEMISTRY. N. A. Bakh and P. I. Dolin. Vestnik Akad. Nauk S.S.S.R. 28, No. 10, 20-33(1958) Oct. (In Russian)

The radiation energy transfer to the media, elementary radiation reactions, and primary chemical processes are reviewed. (R.V.J.)

3676

ORGANIC COOLANT DATA BOOK. Technical Publication No. AT-1. Malcolm McEwen, comp. St. Louis, Monsanto Chemical Company, 1958. 187p.

The first section was included to assist in the identification and characterization of compounds that might result from the decomposition of organic coolants. Sections two through six list the physical, chemical, nuclear, electrical, and mechanical properties of coolant materials. Sections eight, nine, and ten show data on the effects on coolants of gamma and electron irradiations. Handling, storage, and physiological information is given in sections eleven and twelve. (W.L.H.)

Separation Processes for Pu and U

Refer also to abstracts 4306, 4308, 4309, 4310, 4312, 4332, 4343, and 4345.

3677 CF-58-9-83

Oak Ridge National Lab., Tenn.

CHLORINE REMOVAL FROM THE DAREX OFF-GAS. T. A. Gens. Sept. 17, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A 2 M NaOH solution is a satisfactory scrubber for the Darex off-gas if sufficient nitrite is present to reduce all hypochlorite to chloride. If there is not enough nitrite produced in the scrubber solution by the reaction of nitrogen dioxide and nitrogen sesquioxide with sodium hydroxide, more reducing agent must be added. Both nitrite and sulfite rapidly reduce hypochlorite in basic solution. The scrubber solution can be used as long as it remains basic. (auth)

3678 CF-58-11-96

Oak Ridge National Lab., Tenn.

MONTHLY PROGRESS REPORT FOR CHEMICAL DEVELOPMENT, SECTION B [FOR] OCTOBER 1958. R. E. Blanco. Nov. 7, 1958. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The one-hour dissolution rate of 304L stainless steel in 4 or 6 M H_2SO_4 containing 5 g of stainless steel per liter is less than 0.004 mg/min/cm^2. Head-end treatments of synthetic Consolidated Edison fuel do not remove B or Cd which may be added as homogeneous criticality controls. Washing used solvent with 0.1 M KOH followed by a lime slurry has satisfactorily purified solvent which was more highly degraded than is anticipated in the present power reactor fuel processing program. M-388 alloy (99% Ar−1% Ni) dissolves in boiling NaOH solution at essentially the same rate as pure aluminum. Approximately 20 hours was required for dissolution of EBWR plate in 6 M NH_4F. Further sulfex process corrosion studies were performed on Carpenter 20 Cb stainless steel and type 304 stainless steel. Gas impingement specimens of INOR-1 and -8 exposed for 425 hours in fused 50% NaF−50% ZrF_4 at 650°C under a simulated off-gas consisting of 2.4 wt. % H_2−97.6% HF showed rates of 0.003 and 0.09 mils per month, respectively. When irradiated with 1-Mev electrons, diethyl carbonate decomposes to the extent of 5.5 molecules per 100 ev of energy absorbed. Thorium solubility in Hg was found to increase from 0.0024 to 0.0264 wt. % as the temperature was increased from 40 to 356°C. A flowsheet for the lithium amalgam reduction of UF_6 to U has been prepared and demonstrated on a 10-g U scale. (W.L.H.)

3679 HW-57603

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY HAZARDS STUDY OF THE HANFORD

PLUTONIUM CRITICAL MASS LABORATORY. J. A. Berberet, J. W. Healy, and E. D. Clayton. Sept. 30, 1958. 45p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

A facility is described for use in criticality and physical property studies of plutonium systems encountered in radiochemical methods of processing plutonium from reactor fuels. A proposed program of studies is outlined. A description of the proposed facility, site characteristics, and environment is included. Special design features to ensure an efficient and safe facility, experimental equipment, and experimental techniques are discussed. Four figures illustrate design features. Basic hazards which may be encountered are reviewed. General safety rules for plutonium handling are appended. 15 references. (C.H.)

3680 IDO-14450

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CONTINUOUS DISSOLVER THEORY. I. DEVELOPMENT OF GENERAL RELATIONSHIPS FOR A TUBE-FLOW FLOODED DISSOLVER. E. E. Erickson. Nov. 24, 1958. 27p. Contract AT(10-1)-205. $1.00(OTS).

A simplified model for a continuous flooded dissolver was used to develop mathematical relationships for dissolver performance. The model essentially assumes tube or non-mixing flow of dissolvent with countercurrent flow of metal elements through a column and uniform packing characteristics of the metal elements. The reaction rate was assumed to control the rate of dissolution. General relationships were derived on the basis of a first-order and a parabolic rate law, although other rate laws could be used as readily. The dissolution of aluminum in nitric acid served as an example in the development. A general equation was written for dissolver performance for each of the rate laws. The two cases, derived for each of three ideal shapes of elements, gave equations (written in terms of dimensionless parameters) of the same form. The final relationships involved the reaction velocity constant, a packing factor, a shape factor for the metal elements, the dissolvent flow rate, a gas evolution factor, the principal dimension of the initial metal element, the column dimensions, and a function of the concentration. The only difference in the equations for the two rate laws appeared in the latter term. This term involved the dissolvent and metal concentrations in the liquid phase and the reaction stoichiometry. (auth)

3681 ORNL-2592

Oak Ridge National Lab., Tenn.

THE RECOVERY OF URANIUM AND PLUTONIUM FROM STAINLESS STEEL SULFATE DECLADDING SOLUTIONS BY ION EXCHANGE. W. J. Neill and I. R. Higgins. Dec. 11, 1958. 27p. Contract W-7405-eng-26. $1.00(OTS).

A process has been developed on a laboratory scale for the recovery of plutonium, by cation exchange resin treatment, and uranium, by anion exchange treatment, from a stainless steel decladding solution. The plutonium was recovered by treatment with Dowex 50 cation resin after diluting the decladding solution to 0.5 M SO_4^{2-} concentration. The plutonium product, containing >99% of the plutonium, was eluted with nitric acid and contained 4% of the stainless steel and < 0.01 M sulfate ion. The uranium was recovered by passing the plutonium-free decladding solution through Dowex 1 anion resin. More than 99% of the uranium, contaminated with < 0.01% of the stainless steel components, was recovered. (auth)

3682

THE CHEMICAL PROCESSING OF USED REACTOR FUELS. I. L. Jenkins. New Scientist 4, 1443-5(1958) Dec. 4.

Two main types of liquid metal processes for dealing with metallic fuels were examined. In one system plutonium is separated from uranium; in the other, they are kept together. An apparatus used for small-scale processing experiments is described. The main advantage of liquid metal processes compared with aqueous solvent extraction methods are: a quick turn-round of fuel, much smaller volumes of active residues, and some easement of the criticality limitations. (J.H.M.)

CONTROLLED THERMONUCLEAR PROCESSES

3683 CERN-Bib-1

European Organization for Nuclear Research, Geneva.

LIST OF SCIENTIFIC REPORTS ON PLASMA PHYSICS, MAGNETOHYDRODYNAMICS AND THERMONUCLEAR REACTIONS IN THE CERN LIBRARY, DECEMBER 1, 1958. Dec. 8, 1958. 12p.

A list is given of the approximately 170 AEC and UKAEA reports on plasma, magnetohydrodynamics, and thermonuclear reactions found in the CERN Library, Geneva. (T.R.H.)

3684 LAMS-1682

Los Alamos Scientific Lab., N. Mex.

PROPOSED ELECTRON PROBE OF THE DISCHARGE CURRENT IN THE PERHAPSATRON. R. E. Dunaway and O. A. Phillips. May 1954. Decl. Jan. 8, 1959. 16p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

A proposed experiment to detect an axial current concentration in the observed pinches in the Perhapsatron is presented. (J.E.D.)

3685 NYO-6367

Princeton Univ., N. J. Project Matterhorn.

A PROPOSAL FOR THE CONSTRUCTION OF A NEW STELLARATOR "ETUDE." Technical Memorandum No. 22. T. Coor and J. Brault. [1958]. Decl. Aug. 21, 1958. 13p. $3.30(ph OTS); $2.40(mf OTS).

A proposal for the construction of Etude, a stellarator with d-c confining field and a-c heating, providing a plasma continuous in time, is presented. In addition, an outline of plasma physics related to project Matterhorn is given, along with a design description of the stellarator, including requirements and applications. (J.R.D.)

3686 NYO-6371

Princeton Univ., N. J. Project Matterhorn.

ELECTRON TEMPERATURE AND DEGREE OF IONIZATION IN A PLASMA AS OBTAINABLE BY SPECTROSCOPIC MEASUREMENTS. Technical Memo. No. 26. J. M. Berger. [1952]. Decl. Aug. 22, 1958. 7p. $1.80 (ph OTS); $1.80(mf OTS).

The instantaneous intensity ratio of a neutral helium spectral line to one of ionized helium was measured. The measurement was made with a Model B Stellarator, using the 4921 A line of singly ionized helium. In addition, calculations of the intensity ratio to be expected for various values of degree of ionization and electron temperature are presented along with graphs. (J.R.D.)

3687 UCRL-1919
California. Univ., Berkeley. Radiation Lab.
THREE LECTURES ON CONTROLLED THERMONUCLEAR POWER PRODUCTION. Herbert F. York. Aug. 29, 1952. Decl. Oct. 8, 1958. 43p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

Notes from three lectures on considerations pertinent to the problem of utilizing controlled thermonuclear reactions for the production of power by Dr. H. F. York were used to write this report. The fundamental properties of the DD and DT reactions and the reacting substances are discussed. The stellarator, a proposed machine for the controlled production of power from the above reactions, is described. The pinch effect is described, and its possible application to the thermonuclear power problem is considered. (W.D.M.)

3688 UCRL-4550
California. Univ., Livermore. Radiation Lab.
ARC RESEARCH: MINIMUM POWER COIL GEOMETRIES FOR D. C. MAGNETIC MIRRORS. John Fasolo. Aug. 10, 1955. Decl. Nov. 25, 1958. 11p. $3.30(ph OTS); $2.40(mf OTS).

3689 UCRL-4570
California. Univ., [Livermore]. Radiation Lab.
ARC RESEARCH. ADIABATIC INJECTION. William I. Linlor. Sept. 22, 1955. Decl. Nov. 25, 1958. 18p. $3.30(ph OTS); $2.40(mf OTS).

A mathematical formulation of adiabatic, deuteron injection into magnetic mirror machines is presented. (J.R.D.)

3690 UCRL-4571
California. Univ., [Livermore]. Radiation Lab.
ARC RESEARCH. CONTINUOUS INJECTION PROCESSES. William I. Linlor. Sept. 23, 1955. Decl. Nov. 25, 1958. 7p. Contract [W-7405-eng-48]. $1.80 (ph OTS); $1.80(mf OTS).

Non-adiabatic injection processes such as electron energy sink trapping, synchronous damping between arcs, synchronous damping by fields, and recirculation of charge are discussed. (J.R.D.)

3691 UCRL-4646
California. Univ., [Livermore]. Radiation Lab.
PRODUCTION OF A HIGH ENERGY NEUTRAL H OR D BEAM. Gordon Gibson and E. J. Lauer. Jan. 26, 1956. Decl. Nov. 25, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

A method of obtaining high-energy plasma by passing a high-energy (~2 Mev) hydrogen molecular ion beam, H_2^+, through a hydrogen gas target is considered. Resulting collisions leave the molecular ion in an excited unstable state from which it dissociates. The formulas for production of neutral hydrogen beams are developed. (J.R.D.)

3692 UCRL-4696
California. Univ., Livermore. Radiation Lab.
NEUTRAL H ATOM AND MOLECULAR ION (H_2^+) INJECTION INTO THE MIRROR MACHINE AT ENERGIES ABOUT ONE MEV. E. Lauer and G. Gibson. May 11, 1956. Decl. Nov. 25, 1958. 9p. $1.80(ph OTS); $1.80(mf OTS).

The injection schemes which are analyzed belong to the class in which the trapping in confining magnetic field is due to an increase of the e/m of the particles. The best possible estimate is presented on the basis of the available information as to how high an energy would be necessary in order that the gas pressure which could be tolerated would be attainable with present techniques (~10^{-7} mm Hg). (W.D.M.)

3693 CEA-tr-R461
THÉORIE DES SONDES. (Theory of Probes.)
M. Generalov. Translated by M. Bineau from Atomnaya Energ. 4, 183-5(1958). 6p.

In using probes to measure potentials, densities, and temperatures in plasma, perturbations are brought about. In the layer which surrounds the probe an electric field appears which causes a distribution of charges. In existing theories hypotheses are found relative to electric field distribution in a limiting layer, and estimation of the dimensions of the layer are based on these hypotheses. Diffusion approximation equations, which are valid for sufficiently high densities, are used to determine the type of modification of the electric field in the limiting layer. (T.R.H.)

3694
INVERSE PINCH EFFECT. O. A. Anderson, H. P. Furth, J. M. Stone, and R. E. Wright (Univ. of California, Livermore). Phys. Fluids 1, 489-94(1958) Nov.-Dec.

In the conventional pinch effect an ionized gas is enclosed by a conducting cylinder, and a sufficiently large current passing through the gas and returning along the inner wall of the cylinder produces a magnetic field which compresses the gas into an axial filament. A device is described which produces an inverse pinch effect. Here the above conducting cylinder is replaced by an axial rod surrounded by the ionized gas. When a current passes through the gas and returns along the rod the magnetic field pushes the plasma outward, leaving a cylindrical vacuum region behind. The velocity and thickness of the expanding plasma front have been studied optically and by means of magnetic probes. Except at the highest gas densities, the velocity is in good agreement with the "snow plow" theory of Rosenbluth, and the thickness of the front is reasonably consistent with the "snow plow" model. At the higher densities it appears that diffusion of magnetic field into the plasma is significant. The advantages of the inverse pinch effect in studying plasma behavior and the idea of a magnetically stabilized inverse pinch are discussed. (auth)

3695
IGNITION OF A THERMONUCLEAR PLASMA BY HIGH-ENERGY INJECTION. Albert Simon (Oak Ridge National Lab., Tenn.). Phys. Fluids 1, 495-500(1958) Nov.-Dec.

The effect of the neutral gas background on the formation of a thermonuclear plasma by high-energy injection is discussed. Three ways of overcoming this barrier are detailed. The first is by sufficiently reducing the initial gas pressure; the second by injecting sufficient current so that plasma self-shielding or "burnout" occurs; and the third by use of the ion pumping or "gettering" action of the trapped plasma. Numerical examples are given. In particular the requirements for "burnout" do not seem excessively difficult to attain. (auth)

3696
COLLECTIVE OSCILLATIONS IN A COLD PLASMA. P. L. Auer, H. Hurwitz, Jr., and R. D. Miller (General Electric Research Lab., Schenectady, N. Y.). Phys. Fluids 1, 501-14(1958) Nov.-Dec.

The collective motions of a fully ionized cold plasma in a uniform external magnetic field are treated by standard small amplitude theory. Finite temperature and collision effects are neglected. Specializing the analysis to a neutral plasma of uniform unperturbed

density containing electrons and ions of one species, one obtains a dielectric tensor and dispersion relation which is a special example of results previously given by Aström. A detailed discussion of the exact dispersion relation is given for the entire frequency spectrum, and completeness theorems are presented with the aid of scalar potentials representing the electromagnetic field quantities. It is found that when the Alfvén dielectric constant $\alpha = 4\pi n(m + M)c^2/B_0^2$ becomes comparable in magnitude to the ion-to-electron mass ratio, the plasma space charge may play an important role in determining the nature of collective oscillations. In particular, if the axial wavelength of the perturbation is sufficiently large, the singularities of the effective dielectric constant become displaced from the neighborhood of the particle cyclotron frequencies to hybrid frequencies, which, in the limit of high plasma density, become equal to the geometric mean of the cyclotron frequencies and the plasma frequency, respectively. The last two sections discuss particle orbits in idealized oscillatory modes and simplified boundary value problems associated with plasma resonance. (auth)

GEOLOGY AND MINERALOGY

Refer also to abstract 3651.

3697 NYO-3938

Massachusetts Inst. of Tech., Cambridge.

VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM, AND ARGON AND RELATED TOPICS. Fifth Annual Progress Report for 1957-58. Dept. of Geology and Geophysics. Mar. 1, 1958. 249p. Contract AT(30-1)-1381. $36.30(ph OTS); $10.20(mf OTS).

Investigations of world wide age correlations in the Precambrian are described. Beginning stages are outlined for investigations in Australia, South Africa, Brazil, Venezuela, Colombia, the southern Atlantic states, islands in the Caribbean, the Northern Appalachian province, Nova Scotia and Newfoundland, and the Canadian shield area, including Labrador. The progress made on the argon–potassium method of age determination is given. The flame photometric analysis for potassium in micas is reviewed. The feasibility of determining the relative amounts of rubidium, normal strontium, and Sr^{87} in silicate minerals by 15-Mev deuteron bombardment is being studied. The x-ray-diffraction study of glauconite is reported. The preparation of large biotite samples for analysis is discussed. (See also NYO-3936.) (W.D.M.)

3698

DETERMINATION OF URANIUM IN HYDROGEOCHEMICAL PROSPECTING. P. Berthollet and A. Grimbert. Bull. Inform. sci. et tech. No. 22, 12-20(1958) Oct. (In French)

The methods of analysis suggested in the literature and currently in use are reviewed and studied with respect to the requirements of hydrogeochemical prospecting for uranium. A new technique for U determination is presented. The method consists in concentrating a rather large sample (10 ml) directly on a chromatographic paper strip. The uranium present is separated from the other ions by chromatographic extraction and determined by fluorimetry. (auth)

3699

PROPOSITION OF A ZONAL DISTRIBUTION RULE FOR URANIUM CONCENTRATIONS WITH RESPECTS TO PLUTONIC ROCKS. Pierre Routhier and Jean-Pierre Gautsch. Compt. rend. 247, 1750-3(1958) Nov. 17. (In French)

In the French central plateau the uranium concentrations are often associated with Muscovite granites (granulites). A study of this species obtained in Corrèze and compared with samples from Nord-Limousin leads to the proposal of the zonal distribution rule for uranium concentrations. The plicate structure of the Corrèze granites and gneiss is described. (J.S.R.)

3700

ON THE COLLOMORPH MOLYBDENITE AND URANIUM–MOLYBDENUM BLACK OXIDES IN URANIUM DEPOSITS. E. V. Kopchenova and K. V. Skvortsova. Doklady Akad. Nauk S.S.S.R. 123, 159-62 (1958) Nov. 1. (In Russian)

Geology and physical properties of collomorph molybdenite with uraninite nasturate and uranium–molybdenum black oxides are described. The results of the chemical analysis of ores enriched with uranium–molybdenum black oxides and of the spectral analysis of uranium–molybdenum black oxides are tabulated. (R.V.J.)

3701

GEOCHEMICAL SCAVENGING OF STRONTIUM. Clifford Frondel (Harvard Univ., Cambridge, Mass.). Science 128, 1623-4(1958) Dec.

Crandallite, an abundant mineral belonging to the alunite structure type, is a geochemical host for ordinary strontium in the soil profile and the deeper ground-water circulation. It may be useful in the scavenging or storage of the radioisotopes of strontium and certain other elements. (auth)

3702

PRELIMINARY GEOLOGIC MAP OF THE CIRCLE CLIFFS 1 NW QUADRANGLE GARFIELD COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 154. Louis D. Carswell and Deward S. Davidson. Washington, U. S. Geological Survey, 1958. $0.50

3703

PRELIMINARY GEOLOGIC MAP OF THE CIRCLE CLIFFS 2 NE QUADRANGLE GARFIELD COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 157. Glen A. Miller and Robert A. Cadigan. Washington, U. S. Geological Survey, 1958. $0.50.

HEALTH AND SAFETY

3704 AECU-3880

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

PRELIMINARY STUDIES OF SCAVENGING SYSTEMS RELATED TO RADIOACTIVE FALLOUT. Report No. 3 (Letter Report) for August 1 to October 1, 1958. John D. Stockham. Oct. 22, 1958. 7p. ARF Project C 127. Contract AT(11-1)-626. $1.80(ph OTS); $1.80(mf OTS).

Progress is reported in a study on the efficiency of scavenging systems for the removal of strontium-90 from air samples. (For preceding period see M-6677.) (C.H.)

3705 AERE-HP/R-2730

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIOSTRONTIUM IN SOIL, HERBAGE, ANIMAL BONE

AND MILK SAMPLES FROM THE UNITED KINGDOM. 1957 RESULTS. F. J. Bryant, A. Morgan, and G. S. Spicer. Nov. 1958. 23p. $0.49(BIS).

The results for the Sr^{90} analysis in soil, herbage, and sheep bone from sixteen stations in the United Kingdom are reported. The Sr^{90} in the top 4 inches of undisturbed soil in July 1957, ranged from 3.6 to 17.2 mc/km^2. The differences in activity appeared to correspond with variations in the rainfall at the various stations. On lowland farms the activity of herbage samples ranged from 51 to 82 μμc/g calcium, and sheep bone from 7 to 13 μμc/g calcium. Samples from hill farms showed a much wider variation. Whereas the cumulative deposition of Sr^{90} is known to have increased by approximately 50% in the year ending July 1957, the general levels in herbage and sheep bones increased only slightly. The increments were small in relation to sampling errors. In those hill areas where the highest ratios of Sr^{90} to calcium in herbage were found, no apparent increase was observed between 1956 and 1957. The activity of milk samples from a number of drying factories in the United Kingdom lay with few exceptions in the range 4 to 6 μμc/g calcium. The median activity of samples taken at Frome, Somerset during 1957 was 5.1 μμc/g calcium compared with values of 4.1 and 4.4 for 1955 and 1956 respectively. Here again the increase in activity is much smaller than that measured in the soil. These results suggest that at the present time, the contamination of milk and herbage depends mainly on the rate of deposition of Sr^{90} rather than on the cumulative total deposited. (auth)

3706 AERE-Med/M-27

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MEMORANDUM ON THE HAZARDS AND HANDLING OF EPOXIDE RESIN SYSTEMS. Frances M. Turner. Oct. 1958. 9p. $0.25(BIS).

Cases are described which show that materials used in the production of epoxide-resin-polyamine systems can give rise to dermatitis. Animal experiments are mentioned which suggest that toxicity of the resins is relatively low, the polyamines being considerably more toxic and irritant than the uncured resins, which vary in toxicity. The cured resins under test appear to be innocuous. Methods of handling and personal protection which proved satisfactory are described. (auth)

3707 APAE-28(Add.)

Alco Products, Inc., Schenectady, N. Y.

HEALTH PHYSICS REPORT. Addendum [to] APPR-1 SIX MONTH OPERATING CONTRACT REPORT. H. L. Weinberg and J. K. Leslie, eds. Sept. 25, 1958. 4p. Contract AT(11-1)-318. $1.80(ph OTS); $1.80(mf OTS).

No personnel received the maximum permissible weekly dose of 300 mrem in any week during the six months' operating test period. The maximum dose based on the calendar year was 395 mrem. All shipments of radioactive material from the site were made under I.C.C. regulations. A total of 1.9×10^{-2} curies of radioactive liquid waste was discharged to Gunston Cove without exceeding the maximum permissible annual average level of 1×10^{-7} μc/cc. Contamination control of all plant areas was adequately maintained. After improvement, all fixed monitoring instrumentation was operational. (auth)

3708 RISLEY-5006/90

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

INDUSTRIAL TOXICOLOGY REVIEW. VANADIUM AND ITS COMPOUNDS. A. Butterworth. Aug. 7, 1954. 8p.

The physical and chemical properties of vanadium are reviewed. Results are reported from studies on the metabolism, excretion, and toxic effects of vanadium in cats, rabbits, and rats. The clinical symptoms of vanadium poisoning in man are described. In all cases the tongue shows a greenish-black deposit and there is marked tremor of the fingers and arms. Results are summarized from a study of the clinical picture in 19 suspected cases among workers in a metallurgical plant. Urinalysis was found useful in confirming suspected cases when specimens were collected within 24 hours after exposure. No other laboratory test was found useful. Data on maximum permissible atmospheric concentrations are included. It is concluded that the elimination of the vanadium hazard is essentially a problem of dust control. It was also concluded that it is unlikely that work with vanadium carried out on a laboratory scale will present any hazard. (C.H.)

3709 USNRDL-TR-232

Naval Radiological Defense Lab., San Francisco.

FEASIBILITY AND APPLICABILITY OF ROOF WASHDOWN SYSTEM. W. S. Kehrer and M. B. Hawkins. May 7, 1958. 47p.

The feasibility and applicability of a washdown or water curtain system against radioactive fallout for building roofs were evaluated, based on the results of a water requirements experiment plus presently available information. The system was found to be both feasible and applicable. The initial coverage and minimum flow rates for 95 and 99% surface coverage were determined experimentally for aluminum roofing, masonite and composition roll roofing at slopes of 1-to-12 and 1-to-4 on an 8 ft wide by 50 ft long test area. The maximum spacing of nozzles both across and along the roof slope was also determined. The feasibility and applicability of the roof washdown system are discussed in terms of the basic design, comparative cost and effectiveness, water requirements, dependability of the system, and the type and size of buildings on which it is applicable. The basic design of a roof washdown system is described as consisting of a water distribution system, storage and filtration system, water return system, and roof surface system. The comparative costs of roof washdown systems and equally effective (in terms of dose-rate reduction) concrete roofs are given for 1,000, 4,000, 10,000, and 40,000-sq ft roofs on square, single-story buildings with an average roof height of 27 ft. In this range, with the exception of the 1,000-sq ft roof, the cost of a new roof plus roof washdown system is less in all cases than the cost of a concrete roof which would give the equivalent dose-rate reduction. The evaluation is based on commercially available components, including the test surfaces. However, some thoughts are also given on a new general design of buildings and on roofing surfaces to be developed to obtain optimum roof washdown effectiveness. (auth)

3710 AEC-tr-3489

THE PROBLEMS OF SAFEGUARDS AGAINST RADIATION ON ATOMIC AIRCRAFT. (Problemy Zashchity ot radiatsii na stomnom Samolete). A. Sedov. Published in Sovet. Aviatsiya, Oct. 25, 1957. p.4. 5p.

A review of information on the subject matter contained in the foreign press is presented. The discussion includes radiation characteristics and means of protection. Also included is a diagram of the shielding in a

projected aircraft. The probable vulnerability of the atomic aircraft is underscored. (J.R.D.)

3711

FALLOUT PARTICLES OF HIGH SPECIFIC ACTIVITY. B. Gross, A. Aron, and E. Meyer (National Inst. of Tech., Rio de Janeiro) and F. X. Roser, S. Costa Ribeiro, and A. C. Olinto (Catholic Univ., Rio de Janeiro). Acta Phys. Austriaca 12, 187-95(1958).

Particulate air-borne fall-out was measured on filters exposed in a daily contamination survey in Rio de Janeiro, Brazil. On June 25, 1957, a particle of rather uncommon size ($\gamma = 4\mu$) and activity (5×10^{-9} curie) was caught. By applying Way and Wigner's decay law for fission products, its origin could be traced back to the first British H-bomb test in the Christmas Islands 50 days earlier. Analysis of the absorption curve, reduced to parallel beam incidence by means of Gross' transform, and comparison tests with a P^{32} standard led to a separation into 3 main groups of beta emitters present. Their energies identify the various fission products making up the activity of the particle. $Ce^{144} \rightarrow Pr^{144}$ and $Sr^{90} \rightarrow Y^{90}$ constitute its near totality. Particle size, shape, and activity are given; physical implications, as well as possible biological consequences, are mentioned. (auth)

3712

EMISSION OF FLUORIDES FROM INDUSTRIAL PROCESSES; A REVIEW. Konrad T. Semrau (Stanford Research Inst., Menlo Park, Calif.). J. Air Pollution Control Assoc. 7, 92-108(1957) Aug.

An investigation has been made of atmospheric pollution by fluorides emitted from industrial processes in which fluorine compounds are manufactured. Thermodynamic considerations and previous studies indicate that the principal mechanism of liberation of fluorides in high-temperature processes is pyrohydrolysis, which results in formation of HF. The principal variables in pyrohydrolysis in most industrial processes appear to be the equilibrium of the reaction, the water vapor concentration in the process atmosphere, and the factors determining mass transfer. Significant formation of SiF_4 appears to be limited to cases involving thermal decomposition of fluosilicates or reaction of fluorides and silica with acids at relatively low temperatures. Formation of volatile metal fluorides may be a significant mechanism of liberation in some cases but is generally of less importance than pyrohydrolysis. By analogy to known cases, it should be possible to make order-of-magnitude estimates of the probable fluorine emission from a given process if the quantity of input fluorine is known or can be estimated. (J.H.M.)

3713

NATURAL RADIUM 226 CONTENT OF ILLINOIS WATER SUPPLIES. Henry F. Lucas, Jr. and Frank H. Ilcewicz (Argonne National Lab., Lemont, Ill.). J. Am. Water Works Assoc. 50, No. 11, 1523-32(1958) Nov.

The concentration of Ra^{226} has been measured in 200 water samples from 159 municipal water sources. Uniform low concentrations of radium were found in the treated water from all surface sources, whereas both high and low values were found in well water sources. High concentrations of Ra^{226} in nonsandstone wells have been correlated with infiltration of deep sandstone water. Concentrations of Ra^{226} from 1 to 25 $\mu\mu g/l$ were found in wells obtaining water from the three deep sandstone formations. The highest concentrations of radium are associated with water from the St. Peter formation. Although only a few samples have been analyzed, it appears that the concentration of Ra^{226} in shallow sandstone well water is low in northern and central Illinois and high in southern Illinois. Average concentrations of Ra^{226} in water from the various source types are tabulated. The averages in this table do not include treated-water samples, raw-water samples, or samples known to contain water from a different source type. It is seen that concentrations of Ra^{22} in excess of 2 $\mu\mu g/l$ are only found in water from sandstone sources. The effects of various types of treatment of the water, such as filtration, iron removal, and softening, have not been determined because both raw and treated samples were obtained from a single water source at only twelve sites. All types of treatment appear to reduce the concentration, however. (auth)

3714

PERMISSIBLE RADIATION DOSES AND METHODS OF PROTECTION FROM RADIATION. Tibor Predmerszky. Magyar Energiagazdasag 9, No. 9, 343-7(1956). (Translated from Referat. Zhur. Khim. No. 6, 1958, Abstract No. 18437.)

Permissible doses of radioactive radiation are presented. Measuring instruments and measures of safety technique for work with atomic reactors are described.

3715

RADIOACTIVITY DUE TO FISSION PRODUCTS IN BIOLOGICAL MATERIAL. W. V. Mayneord, W. Anderson, R. E. Bentley, L. K. Burton, J. O. Crookall, and N. G. Trott (Royal Cancer Hospital, London). Nature 182, 1473-8(1958) Nov. 29.

Methods are described which are used in determinations of beta- and gamma-emitting fission-product radionuclides in biological materials. Results are presented for a series of samples of cow's milk and human milk. The sampling program for cow's milk covered the week of the accident at the Windscale reactor, and results provide a record of the levels of fission products in milk produced at that time in Cardiganshire, Wales. Data are tabulated. (C.H.)

3716

IODINE-131 IN HUMAN THYROIDS FOLLOWING THE WINDSCALE REACTOR ACCIDENT. G. Maycock and J. Vennart (Radiological Protection Service, Belmont, Eng.). Nature 182, 1545-7(1958) Dec. 6.

Following the Windscale reactor accident of October 1957, measurements were made of iodine-131 levels in the thyroid gland of persons from various sections of the country. The measurements were made in a low-background laboratory using a crystal detector coupled to a photomultiplier tube. The measurements were repeated over a four-month period. Data are tabulated. An attempt is made to correlate the findings with the milk consumption of the subjects, the location of the dairies supplying the milk, and the passage of the atomic cloud over Britain. (C.H.)

3717

PROCEEDINGS OF THE TWELFTH INDUSTRIAL WASTE CONFERENCE: MAY 13, 14 and 15, 1957. Extension Series No. 94, Engineering Extension Department. Lafayette, Ind., Purdue University, 1958. 690p.

Recent developments in the treatment and disposal of various industrial wastes were discussed at this conference. A subject index is included. (C.H.)

3718

ORIGIN AND NATURE OF REACTOR FUEL PROCESS WASTES. L. Hemphill, W. J. Boegly, Jr., and R. J.

Morton (Oak Ridge National Lab., Tenn.). pp. 50-65 in "Proceedings of the Twelfth Industrial Waste Conference, May 13, 14 and 15, 1957." 690p.

Problems associated with the treatment and ultimate disposal of wastes originating from the chemical reprocessing of spent reactor fuels are reviewed. The present practice of storing these wastes in underground tanks is both costly and unsafe. In view of the predicted growth of the nuclear power industry and the resulting increase in volume of reactor fuel process wastes, it is pointed out that it is imperative to develop safe methods of treatment and disposal. Such methods, in addition to being economically feasible, must ensure containment of the dangerous radioactive fission products for centuries. (C.H.)

3719

LEITFADEN DES STRAHLENSCHUTZES FÜR NATURWISSENSCHAFTER, TECHNIKER UND MEDIZINER. (Manual for Radiation Protection for Scientists, Technicians, and Doctors). Hans R. Beck, Hans Dresel, and Hans-Joachim Melching. Stuttgart, Georg Thieme Verlag, 1959. 263p.

As an introduction to the problem of radiation protection, the history of radiation protection is given, and the development of legislation concerning it is traced. The physical properties of ionizing radiation and dosimetry methods are discussed. A brief survey is made of ground radiation. The basis of biological radiation effects is discussed. The radiation damage to the human organism and the damage to descendants are considered. The professional and non-professional radiation exposures are described. A survey is presented of the technological and biological-medical methods used in radiation protection. In conclusion, the organizational and sanitary problems connected with radiation protection from a catastrophe are discussed. (J.S.R.)

3720

HANDBOOK OF FEDERAL REGULATIONS APPLYING TO TRANSPORTATION OF RADIOACTIVE MATERIALS. Washington, United States Atomic Energy Commission, 1955. 52p. Available for $0.25 from U. S. Government Printing Office, Washington.

Regulations are summarized which govern the transportation of radioactive materials within the United States. (C.H.)

3721

SAFE HANDLING OF BODIES CONTAINING RADIOACTIVE ISOTOPES. A Guide for Surgeons, Pathologists, and Funeral Directors. National Bureau of Standards Handbook 65. Washington, National Bureau of Standards, 1958. 26p. Available for $0.15 from Superintendent of Documents, Washington.

Procedures are outlined for the guidance of surgeons, pathologists, and funeral directors who must handle radioactive bodies. (C.H.)

INSTRUMENTS

Refer also to abstracts 4297, 4298, 4303, 4304, 4305, and 4368.

3722 AERE-A/M-2

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN IMPROVED PERMALLOY STRIP MAGNETOMETER. F. M. Russell and H. A. Wilkins. Oct. 1958. 13p.

A modified magnetometer head using a permalloy strip as the sensitive element is described which is capable of measuring magnetic field strengths up to 300 gauss. Two methods of use are described: one is fully automatic and is useful for the rapid scanning of fields while the other can be used for the measurement of the absolute value of the field strength by making spot measurements to an accuracy of better than ±10 milligauss. (auth)

3723 AERE-A/R-2684

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A WATER LEVEL SYSTEM TO MONITOR FOUNDATION SETTLEMENTS. R. B. Clay. Sept. 1958. 20p. $0.42(BIS).

Direct measurements are made by optical means of the depth of fiducial marks below the water surface in a number of interconnected cells placed at a number of points on the foundations. Experiments are described on a mock-up of three cells and their reliability. (auth)

3724 AERE-EL/M-100

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

TWO IONISATION CHAMBERS FOR ACTIVITY MEASUREMENTS ON WIRES USED FOR NEUTRON-FLUX SCANNING. W. Abson and M. Awcock. Sept. 1958. 13p. $0.35(BIS).

The wire activation technique can be used to measure the neutron flux distribution in reactor cores over a wide range of flux levels by a suitable choice of wire materials and irradiation times. Two types of ionization chamber used for the measurement of activity per unit length of wire are described. The first is a gamma-sensitive chamber, active length approximately 10 cm, designed for use with activated tungsten wire in the measurement of neutron flux distribution in large graphite-moderated reactors. The method is suitable for measurements over a range of about 10^9 to 2×10^{13} $n/cm^2/sec$. The second is a beta-sensitive chamber, active length 1.5 cm, designed for use with Ni and MnNi wires for neutron flux distribution measurements in small reactor cores. The method is suitable for measurements over a range from 10^8 to 10^{14} $n/cm^2/sec$.

3725 AERE-EL/M-109

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

STRETCH IN A BOREHOLE CABLE AND ITS POSSIBLE EFFECTS ON THE OPERATION OF BOREHOLE LOGGING EQUIPMENT TYPE 1417A. D. Williams and H. A. G. Cole. Nov. 1958. 7p.

A curious effect was observed during the operation of Borehole Logging Equipment Type 1417A in Rhodesia and Swaziland. With the probe submerged in water at depths greater than 150 ft vertical motion or light jerking of the cable produced spurious high count rates on the ratemeter. It has been suggested that voltage pulses which would be necessary to produce this effect, may be caused by changes in the length and hence capacity of the charged concentric cable connector produced under load conditions. This memorandum analyzes possible effects of cable stretch on instrument performance. (auth)

3726 AERE-T/R-622(Rev.)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INCLINED GROOVE BEARING. R. T. P. Whipple. Oct. 1958. 28p. $0.42(BIS).

Self-lubricating bearings can be constructed if the fixed surface contains parallel inclined grooves, and they can be used either with liquid or gaseous lubricants. The theory of such self pumping inclined groove bearings is developed from first principles and is applied to the "herring bone" bearing in which, from symmetry, there is no net flow of lubricant across the bearing, and also to a bearing in which the grooves are only inclined in one direction. In the latter case there are complications when compressible fluid (i.e., gas) is used as lubricant. (auth)

3727 CF-58-11-99
Oak Ridge National Lab., Tenn.
A STUDY OF GERMANIUM SURFACE BARRIER COUNTERS. F. J. Walter, J. W. T. Dabbs, L. D. Roberts, and H. W. Wright. Nov. 28, 1958. 88p. Contract W-7405-eng-26. $13.80(ph OTS); $4.80(mf OTS).

The properties of Ge surface barrier counters at low temperatures were investigated. Development work on a compact radiation detector suitable for counting alpha particles and fission fragments from nuclei oriented at low temperatures is reported. It was found that, under proper operating conditions, Ge surface barrier counters make excellent detectors for short-range charged particles. Apparent freedom from direct recombination makes them useful for pulse resolution in the case of particles which create different specific ionization densities. Their very fast rise time makes them useful in fast coincidence counting. Compact counters with sensitive areas ranging in size and shape from 3 mm square to 1 inch in diameter are described. (T.R.H.)

3728 KAPL-M-KEW-1
Knolls Atomic Power Lab., Schenectady, N. Y.
PERFORMANCE OF A MINIATURE HIGH-TEMPERATURE, HIGH-LEVEL-RADIATION NEUTRON-SENSITIVE THERMOPILE. K. E. Watkins. Dec. 9, 1958. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A miniature high-temperature neutron-sensitive thermopile has been developed and tested for directly and rapidly performing power reactor core flux measurements. Test facilities at MTR were used to check performance of this design under in-pile conditions. (A.C.)

3729 KAPL-M-RAD-3
Knolls Atomic Power Lab., Schenectady, N. Y.
DELAYED NEUTRON DETECTION STATION EFFICIENCY DETERMINATION. R. A. Dewes. Dec. 23, 1958. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An experiment is described which was designed to test the efficiency of delayed neutron detection equipment. The system was designed for use as a reactor fuel failure detector and locator. The detector was also used as an aid in evaluating the amount of uranium-235 present as surface contamination. (C.H.)

3730 LA-2252
Los Alamos Scientific Lab., N. Mex.
THE (5-PHENYL-2-OXAZOLYL)PYRIDINES AS FLUORESCENT pH INDICATORS. AN APPLICATION TO CHEMICAL RADIATION DOSIMETRY. Donald G. Ott. Aug. 1958. 25p. Contract W-7405-ENG-36. $1.00(OTS).

The three isomeric (5-phenyl-2-oxazolyl)pyridines have been shown to be sensitive fluorescent pH indicators which show a pronounced change to increased visible fluorescence as the pH is lowered. Absorption and fluorescence spectral data and pK_a values are given. Selective excitation of fluorescence from the conjugate acid in the presence of the free base was found possible. The sensitivity of the 4-isomer was demonstrated to be adequate for determining the small amounts of acid produced in certain chemical dosimeter systems. (auth)

3731 NAA-SR-2461
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HEAT FLOW IN THE TRIGGER OF A REACTOR SAFETY DEVICE. Thomas H. Springer and Norman C. Miller. Nov. 15, 1958. 72p. Contract AT-11-1-GEN-8. $2.00(OTS).

The heat flow in the trigger of the Atomics International Mark II reactor safety device was studied experimentally and analytically, utilizing a thin slab approximation to the two-dimensional flow problem. The value for the thermal relaxation time, θ, was determined experimentally to be 1.12 seconds, which agrees reasonably well with results obtained from other experimental procedures. The value of θ was found to depend strongly upon the environmental (air) pressure, the temperature difference, and the slab thickness. To evaluate the dependence, a simplified analytical study was made of the heat flow problem with the aid of a differential analyzer. The results were in agreement with observations made during the experimental investigation and aided in resolving the data. The final value for θ is believed to be accurate to $\pm$ 0.02 second. (auth)

3732 NARF-58-52T
Convair, Fort Worth, Tex.
DIGITAL PULSE INTEGRATOR. B. A. Kelly. Dec. 28, 1958. 41p. Project No. 6(1-9964). Contract AF33 (600)-32054. (MR-N-191).

A digital pulse integrator system has been developed. This system makes possible the accurate measurement of integrated pulse amplitudes from any source without regard to its integral bias curve, if the ratio of maximum to minimum pulse heights falls within a 20:1 range. The system consists of a commercially built linear amplifier, a Convair-built analog-to-digital converter and power supply, and a commercially built data storage and readout unit. The system is linear for converter input pulses of from 5 to 90 volts amplitude and will resolve 1.25-volt variations in the amplitude of these pulses. The system accepts pulses of random height and time distribution and registers counts numerically proportional to the amplitude of the pulses. These counts are then stored and displayed in a scaler. (auth)

3733 NP-7073
Nuclear Codes Group.
NUCLEAR CODES GROUP NEWSLETTER NO. 8. Dec. 8, 1958. 21p.

Compiled and distributed by New York Univ. Atomic Energy Commission Computing and Applied Mathematics Center.

3734 SCR-58
Sandia Corp., Albuquerque, N. Mex.
PHYSICAL AND ELECTRICAL STANDARDIZATION PROGRAM FOR THE AEC. H. C. Biggs. Nov. 1958. 18p. Contract AT(29-1)-789. $0.75(OTS).

Presented at Conference on Electronic Standards and Measurements, National Bureau of Standards, Boulder, Colorado, Aug. 15, 1958.

The development of the functional standards program for the AEC Atomic Weapons System is traced. The needs for such a general program and the factors which influenced decisions for both general organization and choices of equipment are outlined. The technical and administrative guidance provided by NBS personnel is emphasized. Briefly mentioned are audits, intercomparisons with other like laboratories, and technical publications for the purpose of establishing and maintaining a broad coordinated standards program. (auth)

3735 UCRL-8530
California. Univ., Berkeley. Radiation Lab.
AN EFFICIENT COUNTING SYSTEM FOR THE DETECTION OF NEUTRONS FROM LOW-YIELD PULSED NEUTRON SOURCES. Lawrence Ruby and Joseph B. Rechen. Oct. 14, 1958. 16p. Contract W-7405-eng-48. $0.50(OTS).

This system uses a large organic scintillator as a moderator for a burst of fast neutrons, many of which are subsequently captured by the hydrogen in the scintillator. The pulses produced by the 2.2-Mev capture γ rays are observed by four photomultiplier tubes whose anodes are paralleled. The output pulses are amplified and counted by a 10 Mc scaler. The scaler is gated to count for 300 μsec after the pulse, during which interval background is very small. Statistically significant information on total neutron output may be obtained for as few as 10^3 neutrons per pulse, with practically no upper limit. Relative calibration of the system is simple, and absolute calibrations are stable and reproducible. (auth)

3736 WADC-TN-57-335
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
FEASIBILITY OF A GRAPHITE-CARBON DIOXIDE IONIZATION CHAMBER TO MEASURE CARBON DOSE AT HIGH DOSE RATES. [Period covered] April 1957 to November 1957. Robert L. Hickmott. Nov. 1, 1957. 30p. Project and Task title: NUCLEAR INSTRUMENTATION. (AD-142249; PB-131671). $1.00(OTS).

The feasibility of designing a graphite–carbon dioxide ionization chamber for the absolute measurement of the carbon dose rate from a pure gamma field up to 10^{10} erg/g/hr is discussed. There are insufficient data on neutron response to judge the feasibility of using the ion chamber in mixed fields with large neutron components. (auth)

3737 AEC-tr-3530
A NEW PRINCIPLE OF SPECTROMETRY. N. G. Bakhshiyev (Bakhshiev). Translated for Savannah River Lab. from Optika i Spektroskopiya 2, 816-18(1957). 2p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7599.

3738 CEA-tr-R386
ANALYSEUR ELECTROSTATIQUE DES VITESSES DES ELECTRONS. (Electrostatic Analyzer of Electron Velocities.) V. I. Milyutin (Milioutine) and A. N. Kabanov. Translated by B. Vinogradoff from Uspekhi Fiz. Nauk 61, 673-98(1957). 43p.

An apparatus is described in detail which, by means of a unique electrostatic lens, analyzes a beam of electrons by velocity. The principle of operation of the device, its dispersion and resolving power, and some results obtained by using it to analyze electrons traveling through matter are presented. (T.R.H.)

3739 CEA-tr-R466
CALORIMÈTRE À GLACE AVEC ÉTALONNAGE ÉLECTRIQUE. (Glass Calorimeter with Electric Calibration.) M. V. Kniga and K. P. Mischenko (Mistchenko). Translated by B. de Trezvinsky from Zhur. Priklad. Khim. 30, 1708-11(1957). 8p.

The design and construction of a glass isothermal calorimeter to measure the thermal reaction of shale samples with solvents are described. In the construction, consideration was given to the fact that the interaction studied is slow and that the thermal effects observed are weak. The calorimeter is calibrated by the electric method, and the heater used in this calibration is described. (J.S.R.)

3740 CEA-tr-R472
MÉCANISME DE TRANSFERT DE L'ÉNERGIE DANS LES MATIERES PLASTIQUES SCINTILLANTES. (Mechanism of Energy Transfer in Scintillating Plastic Materials.) T. P. Belikova and M. D. Galanin (Galanine). Translated by B. de Trezvinsky from Izvest. Akad. Nauk S.S.S.R. 22, 48-9(1958). 6p.

Index of absorption measurements were made on polystyrene with various concentrations of anthracene and on polystyrene with various concentrations of p-terphenyl. The possibility of energy transfer occurring by resonance induction and by radiation was calculated. The values found confirm the theoretical assumption that resonance induction without radiation is the means of energy transfer in plastics. (T.R.H.)

3741 CEA-tr-R485
CHOIX D'UN CAPTEUR POUR MICROMANOMETRE COMPENSE MAGNETIQUEMENT. (Choice of Transmission for a Magneto-Compensation Micromanometer.) V. I. Bakhtin (Bakhtine). Translated by M. Melnik from Priborostroenie No. 10, 13(1957). 8p.

The considerations to be made in selecting a transmitter for a magnetically-compensated micromanometer are outlined. A suitable device is described. (T.R.H.)

3742 CEA-tr-R501
DÉTERMINATION SOUS VIDE DE LA CONDUCTIVITÉ THERMIQUE DES CORPS RÉFRACTAIRES. (Determination Under Vacuum of the Thermal Conductivity of Refractory Bodies.) D. M. Shakhtin (Chakhtine) and I. J. Vishnevskii (Vichnevsky). Translated by I. Melnick from Zavodskaya Lab. 23, 927-9(1957). 5p.

An apparatus used to determine the thermal conductivity of refractories at high temperatures in a vacuum is described. The apparatus makes an absolute measurement of the constant thermal flux at the surface of the sample. It has resistors of graphite or tantalum so that refractories which react with graphite at 1600 to 1700°C can be tested. The maximum error possible on the coefficient of thermal conductivity is ~20%. (J.S.R.)

3743
STUDY OF A PHOTOMULTIPLIER ESPECIALLY DESIGNED FOR NUCLEAR PHYSICS. G. Pietri. Bull. Inform. sci. et tech. No. 22, 2-9(1958) Oct. (In French)

A study was made of the LEP #204 photomultiplier

tube which was designed with a fast rise time, high gain, and large linear output. The diode geometry and the geometry of the electron optics between cathode and first diode are discussed. Calculated values of rise at the anode for one electron emitted from the cathode or for simultaneous and instantaneous illumination of the whole cathode are given. (auth)

3744

THE SIGNAL-TO-NOISE RATIO IN REGENERATIVE DETECTOR OF NUCLEAR PARAMAGNETIC RESONANCE. I. F. Shchegolev (Inst. of Problems in Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 64-7(1958) Nov. 1. (In Russian)

It is shown that in the bridge design the source of noise is the thermal noise in the circuit and in the regenerative detector. The main noise source is slow fluctuation of the lamp twist appearing due to the flicker effect. (R.V.J.)

3745

PENNING ION SOURCE. Robert Keller. Inds. atomiques 2, No. 9-10, 81-4(1958). (In French)

The design, construction, and operating characteristics of a Penning ion source which is used in the CERN synchrocyclotron are described. Other possible applications of a Penning ion source are discussed. (J.S.R.)

3746

A POWERFUL RADIATION SOURCE FOR LABORATORIES. C. G. Invernizzi (U. S. Radium Corp., Geneva). Inds. atomiques 2, No. 9-10, 153-4(1958). (In French)

A brief description is given of the design and characteristics of the "Gammacell-220," a 59,000-c gamma source. (J.S.R.)

3747

ON THE SENSITIVITY OF SPECTROPHOTOMETRIC METHODS FOR LIGHT SCATTERING MEDIA. A. P. Ivanov. Inzhener. Fiz. Zhur. 1, No. 5, 30-3(1958) May. (In Russian)

The method of determining absorption magnitudes by reflection and permeability spectra was tested on light scattering layers of finite thicknesses. Conditions affording a higher sensitivity are investigated. (tr-auth)

3748

ABSOLUTE SPECTRAL SENSITIVITY OF PHOTOCATHODE FEU-11. M. N. Smolkin. Inzhener. Fiz. Zhur. 1, No. 5, 84-6(1958) May. (In Russian)

Measurements were made of the absolute spectral sensitivity of a shutter type photomultiplier cathode for 240 to 700 $\mu\mu$. (R.V.J.)

3749

A SIMPLIFIED SPECTROMETER FOR THE LONG WAVE INFRARED REGION 20 TO 180 μ. N. G. Yaroslavskii and A. E. Stanevich. Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 6, 50-5(1958) June. (In Russian)

A design is presented of a simple spectrometer for separating lines in the 20 to 180 μ region, based on the method of residual rays and the principle of multiple reflections from alkali-haloid salt crystals. (tr-auth)

3750

PHOTOELECTRIC APPARATUS FOR MEASURING POLARIZATION. G. P. Gurinovich and A. M. Sarzhevskii (Inst. of Physics and Math., Academy of Sciences, Belorussian SSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 8, 58-64(1958) Aug. (In Russian)

Descriptions are given of photoelectric apparatus for measuring the degree of polarization of luminescence and other types of luminosity. The instrument analyzes the electric signal received from a photomultiplier located behind a rotating analyzer. The degree of polarization is determined as the ratio of the variable component of the photocurrent to the constant component. Removal of the glass plates increases the sensitivity of the apparatus considerably. (tr-auth)

3751

APPLICATIONS OF PROTON RESONANCE FOR MEASURING AND STABILIZING WEAK UNIFORM MAGNETIC FIELDS. A. I. Zhernovoi, Yu. S. Egorov, and G. D. Latyshev (Inst. of Transportation, Leningrad). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 8, 95-7 (1958) Aug. (In Russian)

A proton resonance instrument is described which detects a signal-to-noise ratio of not less than 20 by any detection method in a homogeneous magnetic field with a voltage of several oersteds. This permits the measurement and stabilization of weak homogeneous magnetic fields. (tr-auth)

3752

CERENKOV COUNTERS IN HIGH ENERGY PHYSICS. Clyde E. Wiegand (Univ. of California, Berkeley). IRE Trans. Nuclear Sci. NS-5, 77-81(1958) Dec.

Cherenkov counters as particle detectors in high-energy physics experiments are discussed with emphasis on the practical design of velocity-sensitive devices. The performance and problems associated with three types of detectors are considered: simple velocity threshold counters and wide-band and narrow-band velocity selectors. The limitation in resolution of practical velocity-sensitive counters in high energy experiments arises mainly from the characteristics of the beams which must pass through their radiators. These limitations include divergences in the direction of the beam particles, multiple coulomb scattering, and changes in velocity of particles as they pass through the Cherenkov radiator. Methods of coupling radiators to multiplier phototubes include direct optical contact, specular reflection, and diffuse reflection. Magnesium oxide is an excellent diffuse reflector and methods of its application are given. Statistical fluctuations in the small numbers of photoelectrons produced from Cherenkov radiators limit the accuracy with which the times of passage of individual particles are determined. (auth)

3753

FURTHER WORK WITH NOBLE ELEMENT SCINTILLATORS. J. A. Northrop, J. M. Gursky, and A. E. Johnsrud (Los Alamos Scientific Lab., N. Mex.). IRE Trans. Nuclear Sci. NS-5, 81-7(1958) Dec.

An investigation of the relative scintillation efficiencies of the various noble gas mixtures was made in an attempt to find a combination that would yield either more light than any of the pure gases or allow a more economical use of the heavier gases without substantial loss of light. Data on the efficiency of all binary mixtures of Xe, Kr, Ar, Ne, and He are presented. They show a characteristic large drop in the light for mixtures containing a small proportion of the heavier gas in a major fraction of the lighter. However, a 10% Xe–90% He mixture has a relatively large output and could be useful in constructing a high-efficiency neutron counter using the $He^3(n, p)H^3$ reaction. Data are also presented on the relative conversion efficiencies of several commonly used organic waveshifters. Of those tested, the best are diphenyl stilbene, tetra-

phenylbutadiene, and quaterphenyl having relative efficiencies of 1.0, 0.7, and 0.4, respectively. A survey investigation was also made of the relative efficiencies of solid and liquid xenon, krypton, and argon for ordinary glass and for quartz-faced photomultipliers. Although these data are not as accurate or reproducible as the corresponding work on gases, they indicate several of the combinations may approach NaI(Tl) in light output. (auth)

3754

HEAVY ELEMENTS IN PLASTIC SCINTILLATORS. M. Hyman, Jr. and J. J. Ryan (Pilot Chemicals, Inc., Watertown, Mass.). IRE Trans. Nuclear Sci. NS-5, 87-90(1958) Dec.

The objective of this work is to study the possibilities of incorporating into plastic scintillators substantial quantities of heavy element compounds without the introduction of appreciable color or haze. Factors governing the quenching of the light output are considered, and a practical balance is struck between lowered pulse height and the quantity of heavy element introduced. The various components required in a heavy-element-loaded plastic scintillator are outlined, with a discussion of the effects of variations in their chemical character and proportion. Specific approaches to the problem are outlined as follows: (1) the inclusion in the plastic scintillator of organo-metallic compounds, (2) inclusion of essentially non-ionic metal salts, (3) inclusion of chelated metal compounds, (4) use of a base plastic material in which a variety of metal compounds are more soluble than in the standard vinyl-aromatic type of base plastic, and (5) inclusion of a metal compound that is also a monomer. Possible applications to detection of low-energy radiation and of thermal neutrons are discussed. (auth)

3755

FUNDAMENTAL STUDIES OF SCINTILLATION PHENOMENA IN NaI. W. J. Van Sciver and L. Bogart (Levinthal Electronic Products, Inc., Palo Alto, Calif.). IRE Trans. Nuclear Sci. NS-5, 90-2(1958) Dec.

Work on pure NaI reported at the Fifth Scintillation Counter Symposium (1956) has been extended using crystals of higher purity at temperatures down to 4°K. Decay of the light pulse from unactivated NaI is not a simple exponential but exhibits a rising component superimposed on an exponential decay. In other measurements, the absolute conversion efficiency (emitted useful light divided by exciting particle energy) was found to be as high as 25% for unactivated NaI at liquid nitrogen temperature (compared with 13% for NaI(Tl) at room temperature. Theoretical and practical implications of the results are discussed. (auth)

3756

GLASS SCINTILLATORS. R. J. Ginther and J. H. Schulman (U. S. Naval Research Lab., Washington). IRE Trans. Nuclear Sci. NS-5, 92-5(1958) Dec.

The preparation of scintillating glasses is currently being studied with principal emphasis on the use of cerium as an activator. The most efficient material investigated to date is a cerium activated high silica glass prepared originally by the Corning Glass Company. The pulse height of this material has been found to be as high as 10% that of NaI(Tl), but its efficiency is dependent upon the purity of the high silica glass from which it is prepared. Conventional meltable glasses activated with cerium have been prepared which have a pulse height of 7% of NaI(Tl). The pulse height of these meltable glasses is dependent upon their composition. Alkaline earths have been found to be deleterious, whereas the presence of aluminum has been found to be beneficial. The most efficient composition to date has been found to be $1.0Na_2O$, $0.30Ce_2O_3$, 3.0 to $4.0(B_2O_3 + SiO_2)$, 1.0 to $1.3Al_2O_3$. Methods of preparation of both meltable and high silica glass type glasses as well as their optical properties are described. (auth)

3757

INELASTIC NUCLEAR REACTIONS OF PROTONS IN SCINTILLATORS. L. H. Johnston, D. H. Service, and D. A. Swenson (Univ. of Minnesota, Minneapolis). IRE Trans. Nuclear Sci. NS-5, 95-8(1958) Dec.

When a scintillation counter is used as a spectrometer for energetic protons, corrections must be made for the fact that (p,n) and other nuclear reactions may occur in the scintillator, causing some of the protons to register substandard pulse heights. These corrections were measured for thalliated sodium iodide, and for plastic scintillators at proton energies between 10 and 40 Mev, by measuring the pulse-height spectrum produced by a proton beam of homogeneous energy striking the crystal. The homogeneous beam is obtained by collimating a linear accelerator beam to one-eighth inch diameter, then magnetically analyzing to get rid of the slit-scattered protons. (auth)

3758

DESIGN OF PHOTOMULTIPLIERS FOR THE SUB-MILLIMICROSECOND REGION. G. A. Morton, R. M. Matheson, and M. H. Greenblatt (RCA Labs., Princeton, N. J.). IRE Trans. Nuclear Sci. NS-5, 98-104(1958) Dec.

In considering the design of a photomultiplier with good time resolution characteristics, it is convenient to divide the problem into two parts, one dealing with the photocathode-to-first dynode region, the other with the secondary emission multiplier structure. The two principal causes of poor time resolution in both of these parts are: (1) the different path lengths of electrons originating from separated points on a second and (2) the effect of initial velocities of the emitted electrons on transit times. The electron optical approach to the alleviation of the transit time spread due to path differences is discussed for both the cathode region and the structure. The focusing spiral method of analyzing the performance of a structure is of considerable value. The effects of initial velocities can be reduced by ensuring that the electron velocities within the photomultiplier are very high. It is not practical to obtain these high velocities simply by applying a high over-all voltage to the tube because of the loss of secondary emission gain and because of internal and external insulation difficulties. However, the necessary high velocities can be obtained by the use of high voltage field electrodes between successive dynodes, so arranged that electrons are rapidly accelerated to a high velocity and then decelerated before they reach the next dynode. A photomultiplier is described whose design is based upon these two principles. A high voltage central electrode system between successive dynodes serves to give electrons the high velocity required to minimize transit time spread. Calculated and measured characteristics of this structure are given. When operated in conjunction with suitable circuitry, resolutions of a few micromicroseconds should be obtainable. (auth)

3759

FATIGUE IN PHOTOMULTIPLIERS. L. Cathey (E. I. du Pont de Nemours and Co., Aiken, S. C.). IRE Trans. Nuclear Sci. NS-5, 109-14(1958) Dec.

The change of gain with time of two types of dynodes used in photomultipliers has been studied at several current levels and under repeated fatigue cycles. The fatigue of the photomultiplier takes place predominantly in the last few dynodes. The magnitudes and time dependence of the fatigue vary with dynode current, temperature, construction, and past history. (auth)

3760

STATUS OF MULTIPLIER-PHOTOTUBE DEVELOPMENT FOR SCINTILLATION COUNTERS. William Widmaier (RCA Electron Tube Div., Lancaster, Penna.). IRE Trans. Nuclear Sci. NS-5, 114-17(1958) Dec.

A number of recent developments have contributed to the design of multiplier phototubes having improved time discrimination, as well as improved pulse-height resolution. In the 6810-A, a modified version of the first commercial high-gain, high-speed tube, a curved faceplate (flat on the outside) is used to reduce transit-time variations in the region between the photocathode and the first dynode. Special geometrical construction is used to minimize transit-time spread in the 7046 five-inch tube. Curvature of the inner faceplate is also used to improve pulse-height resolution and time discrimination of developmental versions of the 6342 and the 6655. In a new developmental tube, RCA Dev. No. C-7251, cathode curvature is combined with a new electrode structure between the cathode and the multiplier structure to reduce transit-time spread to less than a few tenths of a millimicrosecond. (auth)

3761

SPECIAL PURPOSE MULTIPLIER PHOTOTUBES FOR SCINTILLATION COUNTING. Frederick W. Schenkel (Allen B. Du Mont Labs., Inc., Passaic, N. J.). IRE Trans. Nuclear Sci. NS-5, 117-20(1958) Dec.

A discussion on linear and box-type multiplier phototubes is presented. Various aspects of dynode geometry and front-end design of the Du Mont linear type multiplier structure in regard to transit time and transit-time spread are discussed. Several methods of operation of the front end of a multiplier phototube are considered in order to determine the optimum conditions for collection efficiency and transit-time spread. The mechanical requirements of various linear multiplier phototube types are discussed briefly. The development of linear tube types has come about as a result of an increasing demand for fast tubes capable of delivering high peak pulse output currents. (auth)

3762

RECENT WORK ON PHOTOEMISSION AND DARK EMISSION PROBLEMS. R. W. Engstrom, R. G. Stoudenheimer, H. L. Palmer, and D. A. Bly (RCA Electron Tube Div., Lancaster, Penna.). IRE Trans. Nuclear Sci. NS-5, 120-4(1958) Dec.

Recent developments have resulted in multiplier phototubes having wider spectral responses from the ultraviolet to the infrared, having higher absolute sensitivity, and having lower dark emission. The multialkali photocathode discovered by Sommer is now being used in the development type multiplier phototube, C7237. Despite the very high red sensitivity of this cathode, the dark emission is a factor 10 lower than that of antimony–cesium cathodes used in typical scintillation counters. Output dark current is basically due to the photocathode dark emission, but this is sometimes increased by regenerative processes. In a special sixteen-stage developmental type with a sealed-in optical shield, the dark current was kept to a minimum for gains as high as 10^9 to 10^{10}. Photocathodes of very high quantum efficiency have been achieved on the 7029 multiplier phototube type of means of an internally evaporated-front-surface photocathode of the antimony–cesium type. Absolute comparisons of special characteristics are presented for the photocathodes mentioned above, as well as for the ultraviolet-sensitive 6903 and for the 7102 multiplier phototube which has red and infrared sensitivity. (auth)

3763

ANALYSIS OF GAMMA RAY SCINTILLATION SPECTRA FOR QUANTITATIVE PHOTON INTENSITIES. N. H. Lazar (Oak Ridge National Lab., Tenn.). IRE Trans. Nuclear Sci. NS-5, 138-46(1958) Dec.

The various considerations necessary for conversion of the pulse-height spectrum from NaI(Tl) spectrometers to photon intensity distributions are discussed. Some of these are: (1) resolution and efficiency of the crystal; (2) summing of cascade gamma rays; (3) source geometry and self-absorption; and (4) handling of positron emitters. A straightforward empirical method for subtracting the Compton distributions associated with the various gamma rays in a complex spectrum is indicated, and the logical extension to continuous photon distributions is discussed. (auth)

3764

MEASUREMENT OF TIME OF FLIGHT IN THE MILLIMICROSECOND REGION. H. W. Lefevre (Univ. of Wisconsin, Madison) and J. T. Russell (General Electric Co., Richland, Wash.). IRE Trans. Nuclear Sci. NS-5, 146-52(1958) Dec.

The Hanford system for measurement of neutron time of flight differs from conventional techniques only in the use of a vernier chronotron for time interval measurements. The chronotron consists of two circulating transmission lines with a single fast coincidence circuit between them. The line lengths are adjusted to give slightly different circulation periods. By counting the number of circulations necessary to bring two noncoincident pulses into coincidence, a number is obtained which is a measure of the time interval in terms of the difference in circulation periods. This number is used as the channel address for storage in a Radiation Counter Laboratories 256 channel analyzer. Discussion of the vernier chronotron includes: (1) The factors determining channel width, stability and uniformity, (2) use of the RCA 6810 for starting circulation directly, (3) performance of the system as determined with prompt gamma ray cascades, and (4) performance of the instrument in conjunction with the other components of the time-of-flight system. (auth)

3765

A SODIUM IODIDE (Tl) TOTAL ABSORPTION SPECTROMETER FOR HIGH ENERGIES. A. W. Knudsen and R. Hofstadter (Stanford Univ., Calif.). IRE Trans. Nuclear Sci. NS-5, 152-5(1958) Dec.

A scintillation counter employing a 70-lb NaI(Tl) crystal and a Swiss (AfiF) multiplier phototube has been tested with electrons of energy up to 600 Mev. The plot of pulse height vs. energy of incident electrons is found to be linear up to the highest energy tested (600 Mev). Energy resolution of 16 per cent has been

obtained at 350 Mev. The crystal is 9½ inches both in diameter and length. The incident radiation, which can be either electrons or gamma rays, induces a cascade electromagnetic shower within the mass of the crystal giving rise to light which enters the photomultiplier tube. Graphs showing linearity in energy response are presented as well as plots of line shape at constant energy of the incident particle. The procedure for obtaining line breadth semitheoretically is described, and the breadth so derived compared with the value obtained in actual practice. Details of the airtight crystal enclosure and of the crystal-photomultiplier optical coupling system are shown. (auth)

3766

UNSCRAMBLING OF GAMMA-RAY SCINTILLATION SPECTROMETER PULSE-HEIGHT DISTRIBUTIONS. J. H. Hubbell (National Bureau of Standards, Washington) and N. E. Scofield (U. S. Naval Radiological Defense Lab., San Francisco). IRE Trans. Nuclear Sci. NS-5, 156-8(1958) Dec.

The construction of a matrix expressing the response of a large sodium iodide crystal to axially incident 0.01 to 8-Mev gamma rays is described. Interpolation from measured and calculated pulse-height distributions due to monoergic sources yielded a series of distributions at source-energy intervals uniform in the square root of energy. Each distribution was normalized to the total detection efficiency of the crystal and divided into "bins" whose centers were spaced at the above source-energy intervals. Integrated values of the contents of all such bins were written as a triangular matrix. Inversion of this matrix was performed on an automatic computer. Reduction of an experimental pulse-height distribution to a spectrum is effected by first expressing the distribution as a series of bin contents as above, then multiplying this series by the inverse response matrix, and finally dividing by bin widths to give photons per Mev. (auth)

3767

SCINTILLATION COUNTING IN EXPERIMENTS ON PARITY CONSERVATION. R. W. Hayward and D. D. Hoppes (National Bureau of Standards, Washington). IRE Trans. Nuclear Sci. NS-5, 161-6(1958) Dec.

The scintillation counter has played a key role in many of the recent experiments pertaining to the conservation of parity and other symmetry principles in weak interactions. Although in many instances the development of the techniques of scintillation counting, per se, has been limited, the applications to which these techniques have been put are sufficiently novel to warrant a general review of these applications to the measurement of certain dynamical quantities in weak interactions. These quantities include the momentum and angular distribution of emission with respect to nuclear polarization direction of beta particles from polarized nuclei, the longitudinal polarization of these beta particles, the circular polarization and angular distribution of gamma rays following the beta decay process, and any correlations of these quantities with one another or with the nuclear recoil. Particular emphasis is placed on the scintillation spectroscopy of beta particles performed within the vacuum space of a cryostat where the temperature of the detector is of the order of 1°K and that of the source is below 0.01°K and where high magnetic fields are present. (auth)

3768

APPLICATIONS OF LIQUID SCINTILLATION COUNTERS. F. Newton Hayes (Los Alamos Scientific Lab., N. Mex.). IRE Trans. Nuclear Sci. NS-5, 166-70 (1958) Dec.

The liquid scintillator, in just a few years of development, has shown itself to be an extremely versatile chemical system for radiation detection. Its evolution was characterized by penetration into almost every phase of experimental science. A survey of the most notable applications of liquid scintillation counting is presented. (auth)

3769

APPLICATION OF SCINTILLATION COUNTERS TO REACTORS. William W. Managan (Argonne National Lab., Lemont, Ill.). IRE Trans. Nuclear Sci. NS-5, 171-7(1958) Dec.

Gamma sensitive scintillators may be applied to low power training reactors and reactor critical experiments where the residual fission fragment gamma activity is kept low. Some results of applying gamma sensitive scintillators with linear and log-n-period circuits to reactor critical experiments are compared to results obtained with conventional neutron sensitive counters and ion chambers. Relative performances and reliability are discussed. One advantage found is a reduction in the time required to sense an unsafe condition. Power reactor problems of monitoring for excessive exhaust stack gas activity and for fission fragment leakage from defective fuel elements are also discussed. (auth)

3770

A DIFFERENTIAL CHERENKOV COUNTER. D. E. Baldwin, C. Burrowes, D. O. Caldwell, et al. (Massachusetts Inst. of Tech., Cambridge). IRE Trans. Nuclear Sci. NS-5, 177-8(1958) Dec.

A beam of parallel particles of given velocity traversing a transparent radiator gives off Cherenkov radiation at a unique angle with respect to the beam direction independently of the point of traversal. Such light can be brought to a ring focus. A Cherenkov counter has been built using this principle. Velocity definition is obtained by using a ring diaphragm on the face of a photomultiplier. The greatest velocity definition is obtained for small angle Cherenkov light. To change the velocity selection without changing the optics, the index of refraction of the radiator is varied. The index of refraction may be varied by changing the pressure of a gas near its critical point. The working fluid is Fluorochemical FC-75. The index of refraction of FC-75 can be varied continuously from $n = 1.15$ to $n = 1.01$ at a temperature of 250°C by changing the pressure. The counter has been tested using 1.8 Bev/c π mesons from the Brookhaven Cosmotron; the counting rate vs. pressure of the FC-75 has a full width corresponding to less than $\Delta\beta = 0.01$. (auth)

3771

DECAY TIMES OF SCINTILLATORS. R. K. Swank, H. B. Phillips, W. L. Buck, and L. J. Basile (Argonne National Lab., Lemont, Ill.). IRE Trans. Nuclear Sci. NS-5, 183-7(1958) Dec.

The rate of decay of luminescence following excitation by a high energy particle is an important parameter both in application and interpretation of scintillation phenomena. Two of the present authors developed a more accurate method of measuring scintillation decay, using a pulsed x-ray tube. However, the intensity and time resolution of that apparatus was not adequate for the measurement of all interesting scintillators. A new apparatus has been constructed in which cathode rays are used to excite the scintillator. Cathode-ray

pulses as short as 10^{-10} sec are generated by sweeping a cathode-ray beam across a narrow slit. The emergent electrons in the pulse are accelerated to ~80 kev and pass through a thin window to strike the scintillator. The latter may be a crystal, plastic, or liquid. The light from the scintillator is detected and amplified by a multiplier phototube, type IP28. The currents from the anode and last dynode are fed through 120-ohm transmission lines to a traveling-wave oscilloscope. A value of 2.15×10^{-9} sec is obtained for the decay time of scintillations from a solution of 5 g/l of terphenyl in toluene, in agreement with previous measurements. The apparatus is currently being used to study the dependence of the decay time on solute concentration in liquid and plastic scintillators. The decay time is found to increase with decreasing concentration, as predicted by the current theories of energy transfer. Further investigations of the nature of the process of energy transfer in plastics are being carried out by measurements of the shape of the decay curve. A description of the apparatus and some of the more interesting results are presented. (auth)

3772

A HIGH STABILITY GAMMA-RAY SPECTROMETER FOR USE AT HIGH COUNTING RATES. W. B. Nelligan and J. Tittman (Schlumberger Well Surveying Corp., Ridgefield, Conn.). IRE Trans. Nuclear Sci. NS-5, 187-90(1958) Dec.

A spectrometer has been developed for rapid quantitative determination of nitrogen content in bulk media using neutron capture gamma-ray analysis. Four NaI(Tl) scintillation detectors, each operated at counting rates of the order of 10^5 per second, are utilized to permit rapid measurement. Resolution loss due to pile-up is minimized by the use of a 40-millimicrosecond pulse width at the photomultiplier anode followed directly by a low level biased silicon diode preselector. Those portions of pulses exceeding the diode bias are stretched and the four stretcher outputs are fed to a common amplifier of the nonoverloading type which has been modified to improve stability. The preselector reduces by almost two orders of magnitude the effective pulse rate which must be handled by the amplifier. Since pulse-height stability requirements are stringent, temperature regulation of the scintillation detectors and preselector units is used. Detailed measurements indicate that the NaI crystal-plus-photomultiplier combination contributes more instability than all the other spectrometer components combined. (auth)

3773

MULTICHANNEL SPECTROMETER DETECTOR. H. W. Kendall (Stanford Univ., Calif.) IRE Trans. Nuclear Sci. NS-5, 190-4(1958) Dec.

The use of a multichannel detector in the focal plane of a magnetic spectrometer effectively decouples the well-known reciprocal relation between spectrometer resolution and transmission applicable to single-channel detection. The Stanford 36-inch magnetic spectrometer is used in electron-scattering experiments in conjuction with the Mark III linear electron accelerator. In order to utilize the full momentum acceptance of the spectrometer ($\Delta p/p \simeq 0.05$), a 10-channel prototype of a 50-channel scintillation-Cherenkov detection system was constructed which will possess a resolution ($p/\Delta p \sim 1000$) close to the maximum obtainable from the spectrometer. The momentum channels are defined by small scintillation counters which detect ionizing particles, consisting primarily of high-energy pions and electrons. Electrons are distinguished from mesons by Cherenkov counters which back up blocks of 10 scintillators. A coincidence is required ($2\tau \simeq 3 + 10^{-8}$ μsec) between a scintillation detector and the associated Cherenkov counter. A 256-channel computer-type ferrite core memory (Radiation Counter Laboratories Mark 20), divided into four manually or electronically-selected blocks of 64 channels, is used to store the information from the counter array. The use of this large memory allows storage of correlated information in matrix form from two arrays of counters. (auth)

3774

LOW-LEVAL GAMMA RAY DETECTION IN HUMANS. E. C. Anderson and M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). IRE Trans. Nuclear Sci. NS-5, 194-8(1958) Dec.

The problem of measuring gamma activity at the natural levels, particularly in people and foodstuffs, is an extremely important one because of the necessity of monitoring both fall-out from nuclear weapons tests and the disposal of reactor wastes. This problem will also be encountered because of the necessity for minimizing radiation in clinical and industrial tracer applications. Two principal techniques have been developed for this purpose which are applicable to in vivo studies: the NaI crystal spectrometer in a special, low-activity shield, and the large 4π liquid scintillation counter. Both have sensitivities which permit the detection of gamma activity in the human body at levels a factor of 10 to 100 below the natural K-40 concentration. The choice between the two systems depends largely on the particular application, since they are comparable in terms of ultimate sensitivity and cost. The liquid scintillator is the method of choice used for routine studies involving large numbers of samples in which the identity of the activity is known. This is the case, for example, in studies of the gamma activity of people and foodstuffs due to fallout because of the large discrimination factors in biological systems against elements not closely resembling nutritional essentials. Natural K-40 and Cs-137 are normally the only gamma activities present, and the energy resolution of the liquid scintillator permits their simultaneous determination. Because of the constancy and predictability of the K-40 level, additional hard gamma activity (e.g., Ba-140) can be easily detected and identification (in foodstuffs) is often possible on the basis of half-life. The extremely short counting times (2 to 4 minutes per sample) permit the processing of thousands of samples per year. Simple electronics and independence of background rate are very important for routine operation by technicians of limited experience. For complex samples (such as soils), the superior energy resolution of NaI crystal is essential. Ability of the crystal to scan the subject and localize activity is very useful in distinguishing between internal and external contamination and between ingestion and inhalation. It is also important in clinical applications where physiological localization may occur. For the study of complex industrial or natural phenomena, possibility of simultaneous determination of two or more tracers is very useful. Finally, for extremely soft x or gamma rays (e.g. the Pu-239 17-kev x ray) or for bremsstrahlung counting, the crystal is the method of choice. (auth)

3775

THE DECAY TIMES OF ORGANIC SCINTILLATORS AND THEIR APPLICATION TO THE DISCRIMINATION BETWEEN PARTICLES OF DIFFERING SPECIFIC IONIZATION. R. B. Owen (AEA, Harwell, Eng.). IRE Trans. Nuclear Sci. NS-5, 198-201(1958) Dec.

Studies of the differences in the decay time of organic phosphors have shown that, while most of the light is emitted with a short-period fluorescence decay, differences in specific ionization affect the long-term components. It is consequently possible to distinguish between gamma and neutron excitation of many phosphors (including scintillating liquids) by using multiplier photocells having relatively slow response characteristics. Photomultipliers with large-area photocathodes can therefore be used. (auth)

3776

A REVIEW OF THE EMI DEVELOPMENT OF PHOTOMULTIPLIER TUBES. J. Sharpe (EMI Electronics Ltd., Ruislip, Eng.). IRE Trans. Nuclear Sci. NS-5, 202-7(1958) Dec.

The structures of both production and developmental type photomultiplier tubes made by EMI are described and their characteristics presented. A departure from previous EMI tubes which has taken place in the past two years has been the development of a small box and grid structure system and recently a focused dynode system. The dark current characteristics of the EMI tubes are discussed particularly from the point of view of low energy counting. In the limit, a single beta particle of low energy in a scintillating phosphor may cause the emission of only 1 or 2, or 3 photoelectrons, and these are difficult to distinguish from the thermionic electrons emitted from the cathode. The problem is, therefore, to design and use photomultipliers so that as few thermionic electrons as possible are emitted from the cathode, and to reduce the collection of unwanted electrons from other parts of the cathode—D1 space. The results of development along these lines are presented. (auth)

3777

A REVIEW OF 20TH CENTURY PHOTOMULTIPLIERS. A. E. Jennings (20th Century Electronics, Ltd., New Addington, Croydon, Eng.). IRE Trans. Nuclear Sci. NS-5, 208-11(1958) Dec.

The work at 20th Century has been directed primarily at production of replacement units for photomultiplier types presently being produced in the United Kingdom. The tube type selected for study has been the venetian-blind type. A simplified dynode structure made of a single sheet of metal has been developed. Experiments have been conducted on the light utilization by a transparent cathode and results are presented. The collection characteristics of dynodes also have been investigated and the results are presented. Some general principles in tube design are outlined. (auth)

3778

PRESENT STATUS OF SCINTILLATION COUNTER DEVELOPMENT IN FRANCE. J. Labeyrie (C.E.N., Saclay, France). IRE Trans. Nuclear Sci. NS-5, 212-14 (1958) Dec.

Some properties of different types of photomultipliers in commercial use in France, such as background linearity at high currents, transit time fluctuations, and stability for β counting, are discussed. In addition, some properties of different types of scintillators in commercial use or under development are presented. These include amplitude, light spectrum, and decay time temperature for various mineral or organic (solid and liquid) scintillators, and of several gaseous mixtures. The latter part of this paper describes briefly two new French applications of scintillation techniques: gamma spectrometer for aerial prospecting and the use of scintillation counters for measuring thermal neutron fluxes in reactors. (auth)

3779

INSTRUMENTATION AT THE ETH. D. G. Maeder (Eidgenoessische Technische Hochschule, Zurich). IRE Trans. Nuclear Sci. NS-5, 214-21(1958) Dec.

After a brief outline of applications of scintillation counters to nuclear studies at ETH (Eidgenoessische Technische Hochschule), some topics in electronic circuit developments are selected for a more detailed discussion. A linear overload-protected amplifier is described in which pulse shape parameters can be adjusted independently. In the linear amplifier double rectangular pulse shaping is produced by a ferrite core delay line of novel design. Higher order phase corrections are obtained by a combination of inductive and capacitive couplings. Fast timing signals are derived from slow scintillation pulses using a nonlinear amplifier circuit. Amplitude-dependent time jitter is reduced by a special design of interstage couplings. Requirements to be met by pulse stretchers are listed, and a corresponding circuit diagram is presented. Ultrasonic delay lines can be used for the storage of channel counts in a pulse spectrometer. A new type of magnetostrictive transducer has been developed in order to improve the reliability of such a memory. Increased signal amplitude is obtained along with a suppression of unwanted reflections. Straightforward decimal coding, as used in ultrasonic storage and in electrostatic storage type pulse spectrometers, is explained briefly. Automatic data recording from the CRT display of the ultrasonic memory spectrometer is demonstrated. The electrostatic memory spectrometer is demonstrated. The electrostatic memory spectrometer is presently operative with four decimals on each of 32 columns in the storage tube. A possible way of using a pulse spectrometer for automatic computing in the analysis of complex scintillation spectra is suggested. (auth)

3780

ON RADIATION MODULATION. Richmond B. McQuistan (Minneapolis-Honeywell Research Center, Hopkins, Minn.). J. Opt. Soc. Am. 49, 70-4(1959) Jan.

The distribution of modulation frequencies was determined for radiation chopped by passing chopper teeth, whose sides are radii of the chopper wheel, over a circular aperture. The calculation establishes the relationship between the aperture radius-to-chopper wheel radius ratio and the number of notch-tooth pairs that will produce an amplitude of the fundamental frequency equal to the amplitude obtained for the ideal sinusoidal modulation of the radiation emanating from the same aperture. The rms value of the radiation modulated in the assumed manner is also discussed. (auth)

3781

A SIMPLE ORBIT CONTRACTOR FOR BETATRON-STARTED SYNCHROTRONS. J. Moffatt (Clarendon Lab., Oxford). J. Sci. Instr. 35, 447-9(1958) Dec.

The contractor uses a small thyratron to control the current in a coil around the betatron flux of the machine, the current being supplied by the changing betatron flux.

The x-ray yield is increased by a factor varying from three to twenty. (auth)

3782

THE FREE MOLECULE PROBE AND ITS USE FOR THE STUDY OF LEADING EDGE FLOWS. J. A. Laurmann (Univ. of California, Berkeley). Phys. Fluids 1, 469-77(1958) Nov.-Dec.

The development of a free-molecule probe for use as an instrument in the investigation of two-dimensional rarefied gas flow fields is described. The probe consists of a cross-stream cylindrical wire of diameter small compared with the mean free path of the gas. Measurement of the probe temperature and heat transfer characteristics yields information that can be related theoretically to the state of the flowing gas. The use of such information in the study of the qualitative nature of supersonic flow about sharp leading edges in regions where rarefaction, slip, and boundary layer-shock wave interaction effects are important is described. The results showed clearly the effect of increasing density. Thus, at the lowest densities and Mach numbers, a clearly defined shock wave and boundary layer emerged from a region of mixed compressive and viscous action at the leading edge, while at the higher densities and Mach numbers there was a large region of strong boundary layer-shock wave interaction and a considerable delay in the formation of clearly defined shock wave. (auth)

3783

SOVIET MADE ELECTRON MICROSCOPES. Yu. M. Kushnir. Pribory i Tekh. Ekspt. No. 4, 3-18(1958) July-Aug. (In Russian)

Descriptions are given of industrial and laboratory models of various electron microscopes. (tr-auth)

3784

PRECISION MONITOR FOR CYCLOTRONS. V. N. Dobrikov, N. I. Zaika, and O. F. Nemets (Inst. of Physics, Academy of Sciences). Pribory i Tekh. Ekspt. No. 4, 23-5(1958) July-Aug. (In Russian)

A monitor for integrating cyclotron beam currents, with a precision order of 0.1% at current intensity of 10^{-9} amp and over, is described. The effects of leakage are neutralized by a transducer in the integral ionization chamber which acts as a beam current amplifier. (tr-auth)

3785

PERMALLOY TRANSDUCERS FOR MAGNETIC MEASUREMENTS IN ACCELERATORS. K. N. Shorin, Yu. N. Metel'nikov, G. M. Bozin, and L. V. Eremin (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 25-9(1958) July-Aug. (In Russian)

Descriptions are given of a permalloy transducer for measuring static and dynamic magnetic fields in accelerators in the range of 0 to 60 gauss. The sensitivity of the apparatus is 2 to 3×10^{-3} gauss. The scheme automatically eliminates errors of the transducer. Also, a method is offered for measuring distortions in the cyclotron middle magnetic plane. (tr-auth)

3786

BUBBLE CHAMBER WITH LIQUID DEUTERIUM. V. Z. Kolganov, A. V. Lebedev, et al. Pribory i Tekh. Ekspt. No. 4, 30(1958) July-Aug. (In Russian)

It is shown that it is possible to use deuterium as a working fluid in bubble chambers without special purification. It is also shown that liquid hydrogen can substitute for liquid deuterium. (R.V.J.)

3787

IONIZATION CHAMBERS AND APPARATUS FOR STUDYING WIDE ATMOSPHERIC COSMIC RAY SHOWERS. I. M. Bekkerman, V. A. Dmitriev, et al. Pribory i Tekh. Ekspt. No. 4, 31-6(1958) July-Aug. (In Russian)

Descriptions are given of a 60 liter pulse ionization chamber and its leading amplifier and amplitude analyzer. The design and treatment of the chamber permit continuous work. Pulses with amplitudes differing by an order of four are recorded, moreover, the minimum pulse corresponds to a single particle path across the chamber. (tr-auth)

3788

TRANSIENT CHARACTERISTICS OF PHOTOMULTIPLIERS. M. N. Medvedev, E. S. Sokolova, P. I. Filippov, and O. N. Tsislyak (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 4, 37-9(1958) July-Aug. (In Russian)

The shape and transient growth of leading pulses in various types of photomultipliers were investigated; and the opportunities for using them in scintillation counters and Vavilov-Cherenkov counters, operating with fast coincidence schemes, were analyzed. (R.V.J.)

3789

AMPLITUDE ANALYZER WITH AN ELECTRON BEAM TUBE. A. P. Tsitovich. Pribory i Tekh. Ekspt. No. 4, 40-50(1958) July-Aug. (In Russian)

A 49-channel amplitude analyzer with a memory device arranged on an ordinary electron-beam tube, with a screen recording the observed spectrum in linear coordinates, is described. The analyzer has 60 tubes, a resolution time of 20 msec, with a blocked entrance. The apparatus can be switched over to 147 "double" channels with a capacity of 2^{13}. A supplementary design is presented for an arrangement for obtaining the rounding spectrum. (R.V.J.)

3790

MAGNETIC ELECTRON MICROSCOPE UEMB-100. P. A. Stoyanov, V. V. Polivanov, and G. A. Mikhailovskii. Pribory i Tekh. Ekspt. No. 4, 51-60(1958) July-Aug. (In Russian)

A new magnetic electron microscope, UEMB-100, was designed with an increased electron-optical parameter. The electron-optical system consists of an electron canon (the high voltage is supplied by armored lead) and condensed, objective, intermediate, and projection lenses. In contrast to other native apparatuses, the microscope has a high resolving property (up to 20A) and great universality. (tr-auth)

3791

LOCAL SPECTRAL X RAY ANALYSIS DURING ELECTRONOGRAPHIC EXPOSURE "TO REFLECTION." L. G. Orlov, L. G. Sakvarelidze, and L. M. Utevskii (Central Research Inst. of Ferrous Metals). Pribory i Tekh. Ekspt. No. 4, 61-2(1958) July-Aug. (In Russian)

Descriptions are given of a method for the chemical analysis of fine surface layers and a simultaneous phase structure picture produced by exposure to "reflection" in the electronograph EM-4. A specially constructed chamber is used in the investigation of the x-ray spectrum appearing from sliding electron beam incidence on the specimen surface. It is possible to analyze definite local areas (the grain boundary layers in metals and alloys, etc.) by various preliminary treatments of the surfaces. (tr-auth)

3792

SUPERSPEED PULSE OSCILLOGRAPH. L. S.

Bartenev, G. V. Glebovich, L. V. Goryachev, and Yu. A. Sharov (Inst. of Scientific Research in Radiophysics). Pribory i Tekh. Ekspt. No. 4, 63-5(1958) July-Aug. (In Russian)

The principle parts of the superspeed oscillograph are described. Superspeed focusing was developed on the basis of the pulse thyratron ionization properties. The maximum focusing rate is 2×10^9 cm/sec. An electron-beam tube with a deflecting system is used as a transmission line. Pulses of $\sim 5 \times 10^{-10}$ sec can be recorded. (tr-auth)

3793

MEASUREMENT OF DEUTERIUM ABSORBED BY CATHODES IN GAS DISCHARGE. A. M. Rodin, S. P. Vorob'ev, and A. A. Rodina. Pribory i Tekh. Ekspt. No. 4, 78-82(1958) July-Aug. (In Russian)

A mass spectrometer was used for measuring the amounts of deuterium in deuterium-hydrogen mixtures. The method allowed the recording of up to 1×10^{-6} g of deuterium; the precision of the measurements was ±5% with deuterium content over 1 μg. The described method was used for determining the amount of deuterium absorbed by beryllium cathodes during gas discharge. (tr-auth)

3794

RECORDING ANALYZER FOR MULTICOMPONENT GAS MIXTURES. E. I. Rubinshtein and V. I. Fistul. Pribory i Tekh. Ekspt. No. 4, 82-9(1958) July-Aug. (In Russian)

An analyzer based on the principle of the non-magnetic pulse mass spectrometer is described. The apparatus records processes of 0.002 sec duration and over. The results are expressed as peaks on an oscillograph tube screen. (R.V.J.)

3795

VACUUM SPECTROPHOTOMETER. F. I. Vilesov (Leningrad State Univ.). Pribory i Tekh. Ekspt. No. 4, 89-92(1958) July-Aug. (In Russian)

A vacuum spectrophotometer with a convex diffraction lattice for operation in the range 600 to 4500 A is described. The spectra are recorded by an automatic bifilar (loop) oscillograph or electron potentiometer EPP-09. (tr-auth)

3796

DILUTION OF GELATIN EMULSION OF NIKFI-R. T. A. Romanova (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 4, 93-5(1958) July-Aug. (In Russian)

It is shown that it is possible to record relativistic particles with NIKFI-R emulsions diluted 2 to 2.5 times (contains 86 to 87 wt. % silver halide). Attempts were made to record low energy particles with emulsions whose silver halide volume content is reduced 8 times and more, depending on the energy of the particles. (tr-auth)

3797

STABILIZED RECTIFIER. I. G. Gol'deer and V. Yu. Roginskii. Pribory i Tekh. Ekspt. No. 4, 96-7(1958) July-Aug. (In Russian)

A stabilized rectifier supplied from a 200 v triple-phase circuit, which is in some ways more efficient than the serial rectifier, is described. (tr-auth)

3798

HIGH-VOLTAGE HIGH-FREQUENCY STABILIZED RECTIFIER. G. P. Petin (Rostov-on-Don State Univ.). Pribory i Tekh. Ekspt. No. 4, 97-8(1958) July-Aug. (In Russian)

Descriptions are given of a supply scheme for a scintillation detector using the anode voltage as the reference voltage. The anode voltage is stabilized by an electron voltage stabilizer which feeds the high-voltage rectifier, the pulse amplifier, and the amplitude single-channel differential analyzer. The stabilization coefficient of the stabilizer is ~300. (R.V.J.)

3799

RECORDING SPECTROGRAPH WITH A TIMER. A. D. Rusin and V. M. Tatevskii (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 4, 101-2(1958) July-Aug. (In Russian)

An apparatus was developed, on the basis of the mean dispersion quartz spectrograph, for recording spectra on a case drum with respect to time. A time relay opens the spectrograph electromagnetic shutter for each turn of the case drum. The minimum linear motion rate of the film in the case is 500 mm/sec, the maximum is 8,000 mm/sec. The recorded time is plotted on the spectrograph by breaking off the light source with predetermined frequency. (tr-auth)

3800

CONTAINERS FOR STORAGE AND TRANSPORTATION OF LIQUID HELIUM. A. B. Fradkov (Inst. of Problems in Physics, Academy of Sciences). Pribory i Tekh. Ekspt. No. 4, 108-9(1958) July-Aug. (In Russian)

A design is given of a 10 liter Dewar container for liquid He and H_2 storage and transportation. The evaporation of liquid helium in a container with one screen cooled with liquid nitrogen is 0.2 l/day, with an additional intermediate screen it is < 0.1/day. (tr-auth)

3801

A PROLATE SPHEROIDAL FIELD MAGNETIC SPECTROMETER WITH SOURCE NEAR THE EQUATORIAL PLANE. P. R. Evans, N. J. Freeman, G. K. McGinty, et al. (Univ. of London). Proc. Phys. Soc. (London) 72, 949-58(1958) Dec. 1.

A prolate spheroidal field β-spectrometer is described in which the source and detector are located on the same side of the focal ring slit. The trajectories reach distances of up to 38 cm from the axis and the ring slit has a radius of 33 cm. The relation between the resolution and transmission has been measured for four source diameters. Using a scintillation detector of 1.85 cm diameter and 1 cm length, a resolution W of 1.28% at a transmission T of 1% of 4π has been found for a source of 1 cm diameter. For a 1 mm source the measured values range from W = 0.4% at T = 0.8% to W = 1.52% at T = 5.2%. (auth)

METALLURGY AND CERAMICS

Refer also to abstracts 4299, 4300, 4301, 4302, 4313, 4314, 4315, 4316, 4318, 4322, 4333, 4339, 4347, 4362, and 4365.

3802 AECU-3930

Case Inst. of Tech., Cleveland.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 22 [for] September 6, 1958 to December 5, 1958. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Dec. 5, 1958. 5p. Contract AT(11-1)-258. $1.80 (ph OTS); $1.80(mf OTS).

Scaling experiments were performed on zirconium in air and in oxygen at high temperatures, and the results are reported. (J.E.D.)

3803 AECU-3964
Rensselaer Polytechnic Inst., Troy, N. Y.
OPTIMUM SPOT AND SEAM WELDING CONDITIONS FOR ZIRCALOY 3. E. F. Nippes, W. F. Savage, and K. C. Wu. Feb. 1958. 52p. $9.30(ph OTS); $3.60(mf OTS).

The optimum spot-welding conditions for 0.062- and 0.110-in. Zircaloy-3 sheet were determined. The optimum conditions for seam welding were determined only for the 0.062-in. sheet. To obtain a consistent weld strength, the tenacious, low-conductivity surface film must be removed from the surface of Zircaloy-3 sheet. A pickling solution consisting of 100 pts. concentrated HCl (assay 37%) with 1 pt. 48% HF was found to be satisfactory for removing the surface film. After one minute in this solution, a consistent surface contact resistance of the order of 40 microhms was obtained. To simulate actual practice, the effect of storage environment after pickling was studied. The tensile-shear strength of spot-welded Zircaloy-3 was high; however, its normal-tension strength was comparatively low. Welding under an argon atmosphere improved both the tensile-shear and normal-tension strength, but did not materially change the ductility ratio. Tests performed at 500°F showed a decrease in the tensile-shear strength and an increase in the normal-tension strength and the ductility ratio. (auth)

3804 ANL-5861
Argonne National Lab., Lemont, Ill.
STATUS REPORT IN EDDY CURRENT THEORY AND APPLICATION. C. J. Renken, R. G. Myers, and W. J. McGonnagle. Nov. 1958. 76p. Contract W-31-109-eng-38. $2.00(OTS).

New developments and improvements in non-destructive testing techniques by means of eddy currents are presented. The applications include impedance of a coil near a conductor minimizing the effect of probe-to-metal spacing, pulsed eddy current system for gaging plating thickness and for testing liquid metal bonding, multi-frequency eddy current testing system, testing instrument for the determination of wire quality with an application to the spacing wires, and an application to the measurement of the thickness of zirconium cladding on a molybdenum–uranium alloy. (J.E.D.)

3805 BMI-1200
Battelle Memorial Inst., Columbus, Ohio.
CARBIDE COATINGS ON GRAPHITE. John M. Blocher, Jr., Carl J. Ish, Don P. Leiter, Layne F. Plock, and Ivor E. Campbell. June 28, 1957. Decl. Nov. 6, 1958. 58p. Contract W-7405-eng-92. $9.30(ph OTS); $3.60 (mf OTS).

A method has been developed for the uniform coating of graphite tubes with carbides of niobium, tantalum, and zirconium by thermal decomposition of their respective halide vapors. Conditions of coating temperature and pressure are so chosen as to prevent the deposition of metal, but to permit the formation of the carbide as rapidly as carbon can diffuse to the surface. If the carbon diffusion can be made the rate-limiting step, the coating process becomes self-regulating and uniform thickness results. The limits of the temperature-pressure range have been determined experimentally for the thermal decomposition of zirconium iodide and of the chlorides and bromides of niobium, tantalum, and zirconium. With the successful development of coating equipment and definition of conditions, 99 blowpipe test specimens were coated with uniform, continuous, and adherent layers of the carbides in three ranges of thickness, light (0.001 in.), medium (0.005 in.), and heavy (0.01 in.). Determinations were made of the coefficient for the diffusion of carbon in zirconium carbide as a function of temperature. Exploratory work on small specimens of graphite impregnated with 7 wt. % uranium indicated that the coating results were essentially unchanged, but that loss of uranium occurred. Means of avoiding the loss of uranium are discussed. (auth)

3806 BMI-1220(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING AUGUST 1957. Russell W. Dayton and Clyde R. Tipton, Jr. Sept. 1, 1957. Decl. with deletions June 23, 1958. 60p. Contract W-7405-eng-92. $9.30(ph OTS); $3.60(mf OTS).

Investigations are reported on: creep properties of annealed Zircaloy-2 and -3 at high temperatures; burst strength of welded Zircaloy-2 and Zr tubes; room-temperature electrical properties of UO_2–$UO_2(NO_3)_2 \cdot 6H_2O$ specimens; corrosion of 304 ELC stainless steel in chloride-contaminated HNO_3; corrosion rates for U in various electrolytes vs. applied voltage; fatigue-tests of Inconel at 1600°F; oxidation of Nb–Zr alloy in 1000°C wet air; U–Zr–Mo system phase diagram; corrosion of Ta in Na-flow loops; creep and stress-rupture of Ta at 1200°F in He; and pressure bonding of Zircaloy-2 clad compartmented UO_2 fuel plates. (For preceding period see BMI-1213.) (T.R.H.)

3807 BMI-1296
Battelle Memorial Inst., Columbus, Ohio.
NIOBIUM CARBIDE COATING OF GRAPHITE TUBES. John M. Blocher, Jr., Melvin F. Browning, Don P. Leiter, Jr., and Ivor E. Campbell. Oct. 6, 1958. 22p. Contract W-7405-eng-92. $0.75(OTS).

Graphite tubes having a length-to-bore-diameter ratio of 430 were coated on the inside with uniform adherent layers of niobium carbide in thicknesses of 0.002 and 0.004 in. Intimate conformity to the graphite surface and improved uniformity were obtained by reacting $NbCl_5$ vapor with the graphite under pressure-temperature conditions thermodynamically unfavorable for the deposition of niobium by thermal dissociation of the chloride, but favorable for the formation of NbC. Thus, the rate of coating formation depended primarily on the rate of diffusion of carbon through the carbide, which is a function of temperature and independent of vapor-flow considerations over a wide range. Although adherent coatings were obtained on a porous uranium-loaded graphite in the as-received condition, it was necessary to etch a more dense graphite to promote adherence. (auth)

3808 CF-58-8-84
Oak Ridge National Lab., Tenn.
VELOCITY STUDY OF CENTRIFUGAL PUMP IMPELLERS. C. H. Gabbard. Aug. 22, 1958. 11p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A study was made to determine the magnitude of the velocities existing in the various slurry pumps currently in use and to determine possible methods of reducing the velocities in order to obtain longer life. The maximum velocities of the 100A, 200A, and 300A pumps are between 39 and 53.6 fps with the exception of the 100A absolute discharge velocity which is 80.6 fps. For large slurry pumps, it is recommended that lower speeds be used in order to reduce the impeller relative velocities. (auth)

3809 CRMet-802

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CORROSION STUDIES IN HIGH TEMPERATURE WATER ON U-2 W/O Zr ALLOY COEXTRUDED IN ZIRCALOY-2. R. H. Tuxworth and F. H. Krenz. Sept. 1958. 36p. (AECL-702). $1.00(AECL).

Samples of uranium—2 wt. % zirconium alloys sheathed in Zircaloy-2 were exposed to high temperature water. The Zircaloy sheaths were defected by drilling a small hole, allowing water to contact the uranium alloy. In the absence of a diffusion bond between the uranium alloy and the Zircaloy, very rapid corrosion occurred. The addition of 2 wt. % zirconium to the uranium affects the corrosion rate very little, however, it may affect the release of activity to the water. Heat treating the uranium—zirconium alloy to produce a diffusion layer at the Zircaloy—uranium interface produces a corrosion-resistant layer between the sheath and core which can have a marked effect on the corrosion resistance of the element at a defect. (J.R.D.)

3810 DMIC-46E

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM, THERMAL STABILITY OF THE TITANIUM SHEET-ROLLING-PROGRAM ALLOYS. E. S. Bartlett, D. N. Williams, H. R. Ogden, and R. I. Jaffee. Nov. 25, 1958. 46p. Contract AF-18(600)-1375. (AD-205778; PB-151061).

An experimental program was conducted to evaluate the stability of the mechanical properties of heat-treated Ti-6Al-4V, Ti-4Al-3Mo-1V, and Ti-16V-2.5Al sheet alloys during thermal exposures under stress. Triplicate specimens of each alloy, whose initial properties were satisfactory in comparison with Sheet-Rolling Program (SRP) target properties, were exposed under stress calculated to produce creep strains in the range of 0.1 to 0.5 per cent at temperatures of 500, 600, 700, 800, and 900°F. Exposure times were 100 and 1000 hours at each temperature. The thermal exposures showed Ti-6Al-4V and Ti-4Al-3Mo-1V alloys to have comparable creep strengths above 600°F, considerably better than those of the Ti-16V-2.5Al alloy. Tensile test results following the exposures showed that Ti-6Al-4V exhibited a slight trend toward instability at 900°F for 1000 hours, but the degree of instability was not sufficient to warrant concern. The Ti-4Al-3Mo-1V alloy showed indications of overaging during 1000-hour exposure at 900°F, but otherwise exhibited good thermal stability. The overaged properties shown were still within the MAB target properties for the DOP-SRP alloys. The Ti-16V-2.5Al alloy showed some instability under all exposure conditions. Tensile ductility after both exposure times at 500, 600, and 700°F, and after 100 hours at 800°F was below target, and both the yield and ultimate strength values were below target minimum after the 900°F, 1000-hour exposure. After exposure of 100 hours at 900°F, the properties of Ti-16V-2.5Al were satisfactory in reference to target, but the evidence from the other exposure conditions indicates that the alloy under this condition are already passed through the aging peak, and is in the overaging cycle. (auth)

3811 GA-130

General Atomic Div., General Dynamics Corp., San Diego, Calif.

INFLUENCE OF RADIATION UPON CORROSION AND SURFACE REACTIONS OF METALS AND ALLOYS. M. T. Simnad. [1957]. 28p.

Paper presented at the meeting on Radiation Effects on Materials, Johns Hopkins Univ., Baltimore, March 1957.

A discussion of various factors in corrosion of irradiated metallic surfaces is presented. The usual mechanisms of metallic corrosion, such as direct chemical reactions, direct solution (mass transfer), and electrochemical mechanisms, are considered in relation to the effects of light and x rays. In addition, corrosion of reactor materials in aqueous materials is considered. The effect of irradiation on gas—solid reactions is discussed as well as proton irradiation effects on surface reactions. Several tables and graphs are included. (J.R.D.)

3812 HW-45631

[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.]

COMPACTION OF UO_2 BY SWAGING. F. B. Quinlan and W. E. Roake. [Sept. 20, 1956]. Decl. Mar. 11, 1958. 14p. Contract [W-31-109-Eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

A preliminary report of experiments being carried out on the compaction of UO_2 powders by swaging within a restraining tube is presented. Various types of UO_2 were tried with resulting apparent densities as great as 9.89 g/cm^3. (auth)

3813 HW-49555

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HEAD-END FACILITY FOR POWER REACTOR FUEL ELEMENTS. J. G. Bradley and H. E. Hanthorn. Apr. 5, 1957. Decl. Nov. 21, 1958. 10p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A head-end facility for mechanically dismembering and chopping up PRPR fuel elements is described. Additional facilities are described for opening the ends only of valuable Zr-clad fuel elements so that the claddings may be recovered for reuse. Dissolver facilities are provided in each case. An integrated facility capable of recovering U and Pu from PRPR fuels and power reactor fuels, accepting irradiated fuel elements, and reprocessing the recovered U and Pu into recycle fuel is also described briefly. (W.L.H.)

3814 HW-53639

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE DIFFUSION OF XENON IN SILVER. J. Martin Tobin. Oct. 1, 1958. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The diffusion coefficients for xenon in silver were determined at 500, 600, 700, 735, and 800°C. The logarithm of the diffusion coefficient is inversely proportional to the absolute temperature. The measured values of the coefficients can be expressed by equation: $D_{Xe} = 0.036 \exp(-37{,}500/RT)$ cm^2/sec. Thus, the activation energy for diffusion of xenon in silver is 37.5 kcal per gram atom. The diffusion of xenon follows closely the space-time diffusion equation analyzed for the boundary conditions in the sandwich. Under the conditions of the experiment there was little contribution from structurally sensitive diffusion processes such as grain boundary diffusion, crack or void diffusion. (auth)

3815 HW-57207

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FRACTOGRAPHY OF SOME REACTOR FUEL MA-

TERIALS. T. K. Bierlein and B. Mastel. Aug. 15, 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

Experimental procedures are described which have been devised for fractographic studies. Some typical fractographic characteristics for non-irradiated U, UO_2, and Pu are presented. (W.L.H.)

3816 HW-57663

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

BRIGHT-FIELD ETCHES FOR THE METALLOGRAPHY OF URANIUM. R. H. Todd. Oct. 2, 1958. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

With the standard solution of 8 parts ethyl alcohol, 5 parts phosphoric acid, and 5 parts ethylene glycol, two basic etching procedures were developed for producing a bright-field etch. One of these procedures produces a differential coloration of the uranium grains which is suitable for examination and photomicrography. This procedure involves oxidation of the prepared surface at room temperature for about 20 hours. The other procedure places the detail of the uranium microstructure in relief so it may be observed and photographed using oblique light. This procedure requires an alternating etching and polishing technique. (auth)

3817 IGR-R/R-287

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

URANIUM DATA MANUAL. E. L. Francis, comp. May 20, 1958. 59p. $1.75(BIS).

A compilation is given of the best available unclassified data on the physical, mechanical, and chemical properties of uranium and its more important alloys, and the effects of irradiation and thermal cycling on these properties. 76 references. (auth)

3818 IGR-TN/C-305

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

CORROSION OF 18/8 AUSTENITIC STEEL IN NITRIC ACID ENVIRONMENTS CONTAINING CHLORIDES. T. E. Evans and P. A. Hayes. Mar. 13, 1956. 20p. (IGC-SPWP/P-15A).

The factors influencing the corrosion of 18/8 austenitic steel in nitric acid environments containing chloride have been studied in laboratory tests. Selective attack occurs on steel surfaces in contact with condensate but not in bulk solution. Important controlling factors are temperature, free acidity, chloride concentration and dissolved oxygen. The interaction of these factors is complex. Tests involving the dissolution of a South African concentrate gave results similar to those in synthetic solutions of similar composition. The relevance of the findings to the problem of plant corrosion in the cascade dissolvers at Springfields is discussed. (auth)

3819 IGR-TN/CA-974

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

STRESS-CORROSION FAILURE OF A HIGH-PRESSURE WATER/WATER COOLER IN THE DYNAMIC CORROSION LOOP AT CAPENHURST. G. E. Marchment. July 14, 1958. 14p.

Failure occurred in a stainless steel water/water cooler, of the shell-and-coil type, used to cool a water flow from 300 to 40°C in the dynamic corrosion loop. The failure is attributed to stress corrosion in the presence of dissolved chlorides, which occurred in areas where steam is likely to be forming continuously. Although the best long-term solution is to introduce a regenerative heat exchanger to reduce the temperature of the inlet water, an amended design of cooler is suggested for immediate use in the loop. (auth)

3820 MND-1045

Martin Co. Nuclear Div., Baltimore.

SPECIAL WELDING TECHNIQUES. Final Summary Report. John Mueller, William Maxwell, and James Siltanen. Jan. 1957. 97p. For [Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract 558.

The scope of the study described encompassed the selection of welding equipment, the design of tooling, and the development and comparative evaluation of joint configurations and weld schedules. Inconel was used, for the most part, in evolving basic techniques; special studies were carried out in the joining of Inconel X, Hastelloy B, and duplex materials. Industrial-type spot welding equipment was used for making the welds. A few special tools and fixtures were built and are described in the report. (auth)

3821 NAA-SR-2973

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CORROSION AND DECARBURIZATION OF THE FERRITIC CHROMIUM–MOLYBDENUM STEELS IN SODIUM COOLANT SYSTEMS. W. C. Hayes and O. C. Shepard. Dec. 1, 1958. 33p. Contract AT-11-1-GEN-8. $1.00 (OTS).

The commercially available ferritic chromium–molybdenum steels have several advantages over the austenitic stainless steels for sodium coolant systems. The purpose of this work was to investigate both corrosion and carbon transfer phenomena in sodium systems containing both ferritic and austenitic steels. Specimens were exposed at 1025°F in a high-velocity 304 stainless-steel isothermal pump loop and at 1050°F in a low-velocity 304 stainless-steel anisothermal pump loop (500°F temperature gradient) to obtain corrosion and decarburization data. All of the steels showed negligible corrosion rates (aside from carburization-decarburization reactions). Decarburization was encountered in the low-chromium steels. The rate-controlling step in the decarburization reaction appears to have been the diffusion of carbon in the ferritic steels when the austenitic-to-ferritic area ratio was high. The steel containing 5% chromium with titanium, and the 7 and 9% chromium steels were approximately neutral in carbon activity, with respect to 304 stainless steel in a 304 stainless-steel loop containing sodium which was not contaminated with carbon. In a 304 stainless-steel loop containing sodium which was carbon contaminated, steels with 1¼ and 2¼% chromium were decarburized, while steels containing 5% chromium or more were carburized. Capsule tests showed that carbon-saturated sodium decarburized AISI 1010 steel to 0.07% carbon, carburized 1¼% chromium steel to 0.52% carbon, and carburized 2¼% chromium steel to 0.92% carbon. Results of each of these tests indicate that the magnitude of the carbon activity in one steel, in relation to another and/or in relation to the carbon activity of the sodium, determines whether an alloy is decarburized, neutral, or carburized in a sodium system. (auth)

3822 NAA-SR-2981
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REMOTE MAINTENANCE TECHNIQUES FOR THE PROCESSING REFABRICATION EXPERIMENT. Donald J. Stoker. Dec. 1, 1958. 43p. Contract AT-11-1-GEN-8. $1.25(OTS).

In maintaining in-cell process and handling equipment, it is essential that the equipment piece or its components can be remotely replaced. The general techniques developed for replacement of PRE in-cell equipment or equipment components are outlined. General maintenance philosophy is outlined. Utility couplings, method of supplying utilities, mounting of motors, and coupling drive shafts, gaskets, and fasteners are described. (auth)

3823 NAA-SR-3086
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMAL EXPANSION OF Al_2O_3, BeO, MgO, B_4C, SiC, AND TiC ABOVE 1000°C. Charles J. Engberg and Ernest H. Zehms. Nov. 30, 1958. 25p. Contract AT-11-1-GEN-8. $0.75(OTS).

Thermal expansion data on Al_2O_3, BeO, MgO, B_4C, SiC, and TiC were obtained to the temperatures where permanent deformation set in due to sintering or other causes. The thermal expansion for these materials was found to be approximately linear over the measured temperature range. But since a linear extrapolation to room temperature was not possible, the coefficient of thermal expansion is not a constant over this temperature range. The results are compared with the latest published data for each material. The average linear coefficients of thermal expansion are tabulated. All BeO samples which were heated to above 2050°C experienced a very large expansion. Visual examination of the cooled samples revealed that the samples had bent and cracked, physical dimensions had enlarged, and the color had changed to a bright milky white. A brief discussion of the probable reasons for these changes is given. In the attempt to extend the expansion measurements, the melting point of BeO was obtained. A sample of hot pressed BeO melted at 2450 ± 30°C, while a slip cast BeO sample melted at 2470 ± 20°C. (auth)

3824 NLCO-754
National Lead Co. of Ohio, Cincinnati.
THE PREPARATION OF MAGNESIUM METAL: A LITERATURE SEARCH. Earl W. Mautz. June 17, 1958. 41p. Contract AT(30-1)-1156. $1.25(OTS).

The literature on various techniques for the preparation of magnesium metal from magnesium compounds is presented, with an index. References for the magnesium–uranium system are also given. (auth)

3825 NMI-1193
Nuclear Metals, Inc., Concord, Mass.
METALLOGRAPHY OF THORIUM. H. P. Roth. June 17, 1958. 28p. Contract AT(30-1)-1565.

A summary of contributions to thorium metallography from a number of laboratories in the U.S. and abroad is presented. Polishing methods, including electrolytic, cathodic, chemical, and mechanical, are discussed. It is pointed out that none of these methods produces perfect results, however, they are preferred. Photomicrographs are included. (J.R.D.)

3826 NMI-1200
Nuclear Metals, Inc., Cambridge, Mass.
SHAPE CHANGES OF INTERNAL SURFACES IN EXTRUSION. W. B. Nowak and E. J. Rapperport. Mar. 21, 1958. 19p. Contract AT(30-1)-1565. $0.75(OTS).

A presentation is made of two semi-empirical methods for determining shape changes of internal surfaces during extrusion. In each method, a grid is scribed on a meridian (axial) plane to delineate the course of deformation. In the "grid-coördinate" method, the changes in grid shape are directly utilized to determine the internal deformation. The "particle-velocity" method reveals the deformation from analysis of the flow paths and velocity variations of the grid intersections during extrusion. An experimental example of the latter method is presented. (auth)

3827 NMI-1209
Nuclear Metals, Inc., Concord, Mass.
QUARTERLY PROGRESS REPORT TO THE AEC RESEARCH DIVISION FOR THE PERIOD JULY 1, 1958 THROUGH SEPTEMBER 30, 1958. S. H. Gelles and E. J. Rapperport. Nov. 14, 1958. 14p. Contract AT(30-1)-1565. $0.50(OTS).

A program aimed at determining the factors which are important in producing brittle fracture in Be is reported. The effects of impurities and of substructure (dislocation networks, mosaic structure, twins, and deformation marking) will be studied. Studies of twinning in Zr are reported. One part deals with the deformation modes of Zr as functions of temperature and of O_2 content. The other part deals more directly with the problem of twinning, including atom motions during twinning process and the determination of twin indices with the aid of electron microscopy. (W.L.H.)

3828 NMI-4709
Nuclear Metals, Inc., Cambridge, Mass.
COST ESTIMATE FOR THE PRODUCTION OF TWO FUEL ELEMENT ASSEMBLIES. Final Report to the Hanford Atomic Products Operation. A. R. Gilman. June 30, 1958. 97p. Contract AT(30-1)-1565, Sponsor Agreement No. S-45. $15.30(ph OTS); $5.40(mf OTS).

Cost figures are presented for the production of two fuel element assemblies, a 7-rod cluster and a tube with a rod centrally located on its longitudinal axis. The production rate chosen was 1200 tons of uranium per year as finished acceptable fuel element assemblies. Also reported is the effect on cost of variations in fuel element length, diameter, cladding thickness, and throughput. (auth)

3829 NML-5403-1
New York Naval Shipyard. Material Lab., Brooklyn.
REPORT OF DEVELOPMENT OF WATER INDICATING PASTE FOR USE AT ELEVATED TEMPERATURES. Final Report. E. C. Haas. May 21, 1958. 10p. (AD-200352).

The development of a water-indicating paste for use in detecting leaks in pressure vessels at temperatures up to 500°F is described. The formula developed has been laboratory tested to show that it reacts with hot or cold water to give a clearly discernible permanent color change and is essentially unaffected, in its water indicating properties, by 300 hours at 500°F or 300 hours at 100% relative humidity at ambient temperatures, and meets general requirements for an easily applied, adherent (although easily removed by wire-brushing), noncorrosive coating. The formula consists of equal parts of silver chromate and lead chloride mixed with sufficient thinned, phenolic-base, spar varnish to give a smooth paste of desired consistency. (auth)

3830 NP-7111
Mine Safety Appliances Co., Callery, Penna.
TEST OF PROPOSED DESIGN S2G BELLOWS IN SODIUM. Memo Report No. 120. G. E. Kennedy and E. C. King. Sept. 18, 1956. 9p. Contract NObs-65426.

Nine stainless steel bellows of the proposed S2G design were tested. Two bellows were of the Alternate I concentric bellows design and were cyclic tested only. The other seven bellows were of the Alternate II midpoint design and had three different tests applied to them, namely, cycling, abnormal temperature, and abnormal pressure. None of the bellows of the latter design failed. One bellow was cycled 90,000 times and all bellows tested exceeded 30,000 cycles which was the minimum number of cycles chosen as a good test. (auth)

3831 NYO-3953(Del.)
New York Operations Office, AEC.
MACHINING TECHNIQUES AND PROCEDURES FOR URANIUM, GRAPHITE, TITANIUM, ZIRCONIUM, THORIUM, TANTALUM, BERYLLIUM, BISMUTH, LITHIUM, AND STELLITE. Calvin Davis. Nov. 4, 1952. Decl. with deletions Nov. 10, 1958. 89p.

Techniques are presented which are applicable in machining materials such as U, graphite, Ti, Zr, Th, Ta, Be, Bi, Li, and stellite. Included in the general considerations are factors related to machinability of the materials, operating condition of the machines, and the condition of the cutting tools. In addition, industrial hygiene and safety aspects are examined. The techniques for each material are discussed in detail, the greatest attention being focused on uranium. (J.R.D.)

3832 ORNL-2402
Oak Ridge National Lab., Tenn.
HIGH-TEMPERATURE MECHANICAL PROPERTIES OF HASTELLOY B AND HASTELLOY W. C. R. Kennedy and D. A. Douglas. Nov. 28, 1958. 81p. Contract W-7405-eng-26. $2.25(OTS).

The high-temperature properties of Hastelloys B and W were investigated. The results are discussed in terms of creep, microstructures, effects of aging, and effects of environment. The alloys were found to have good high-temperature strength and resistance to fused-salt corrosion; however, a severe loss of ductility at high temperature restricts their use. Graphs, photomicrographs, and phase diagrams are included. (J.R.D.)

3833 RM-2201(RAND)
RAND Corp., Santa Monica, Calif.
A PROPOSED METHOD FOR OBTAINING DUCTILITY IN BERYLLIUM BY THE USE OF A COMPOSITE ARRANGEMENT. W. R. Micks. May 1, 1958. 11p. (AD-156037).

A method is proposed for obtaining the ductile behavior of beryllium by making use of a laminated-grain composite arrangement. By building into the beryllium the mechanism for plastic deformation, and by exploiting beneficial surface effects to favor ductile behavior over that of brittle fracture, sufficient isotropic ductility might be obtained to make beryllium attractive as a structural material. It is suggested that this scheme be tried, in view of the small cost relative to the large potential benefits. (auth)

3834 SCNC-259
Sylvania-Corning Nuclear Corp., Bayside, N. Y.
METHODS FOR FABRICATION AND PROPERTIES OF POROUS URANIUM FUEL ELEMENTS. I. Sheinhartz. May 1958. 23p. Contract AT-30-1-GEN-366. $4.80 (ph OTS); $2.70(mf OTS).

Uranium fuel elements with a controlled, interconnected porosity are frequently considered as desirable because they can provide a reservoir and escape path for the fission gases developed under operating conditions. The manufacture is discussed of porous uranium by the application of powder metallurgical methods, such as hot pressing, hot rolling, and hot rolling with subsequent swaging. The effects of powder particle size, compacting pressure and temperature on the porosity are described. The effects of porosity on strength, thermal cycling behavior, and behavior of porous uranium specimens under irradiation are briefly discussed. Suggestions are made with respect to a possible correlation between the behavior of a metal powder compact during sintering and the behavior of the sintered compact under irradiation. (auth)

3835 WADC-TR-55-330
Forest Products Lab., Madison, Wis.
A STUDY OF THE DETERIORATION OF ADHESIVES IN METAL BONDS AT HIGH TEMPERATURES. J. M. Black and R. F. Blomquist. June 1955. 44p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Contract DO33(616)-54-11. (PB-131500). $1.25(OTS).

The elevated-temperature performance characteristics of phenol-formaldehyde-epoxy resin adhesives were examined. The thermal resistance of adhesive bonds was investigated in aluminum and stainless steel, as affected by preparation of the metal surface, curing conditions, aging temperature, atmosphere during aging, stress during aging, and aging time. A discussion of results is included along with tables and graphs. (J.R.D.)

3836 WADC-TR-57-343(Pt. II)
Crucible Steel Co. of America, Pittsburgh.
A STUDY OF THE METALLURGICAL PROPERTIES THAT ARE NECESSARY FOR SATISFACTORY BEARING PERFORMANCE AND THE DEVELOPMENT OF IMPROVED BEARING ALLOYS FOR SERVICE UP TO 1000°F. [Period covered]: April 1, 1957 to March 31, 1958. T. V. Philip, A. E. Nehrenberg, and G. Steven. Sept. 15, 1958. 63p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3318. (AD-203524).

To develop a bearing steel for operating temperatures up to 1000°F, fifty-one experimental compositions were studied. The theoretical considerations are described which formed the basis of the formulation of these steels as well as the annealing cycle, austenitizing temperature survey, and the tempering survey. The results of the tempering studies are plotted as "master tempering curves." From the study of the temper resistance, eight steels were selected for further evaluation tests. These tests consisted of hot hardness determinations, dimensional stability measurements, compression tests at room temperature and elevated temperature, oxidation resistance, and hot oil corrosion resistance. As a result of the foregoing tests, a steel of the following composition is recommended for use as a bearing steel for operating temperatures up to 1000°F: C—1.09, Cr—4.2, V—1.9, W—6.7, Mo—3.7, and Co—5.2. The steel should be heat-treated as follows: austenitize at 2225°F, oil quench, and temper for two consecutive 2-hour periods at 1050°F. This work has not only developed a steel for elevated-temperature bearing applications but it has also clarified the effects of alloying elements on secondary hardness, hardness retention at

elevated temperatures, and other properties desired of a high-temperature bearing steel. (auth)

3837 WADC-TR-57-589
Curtiss-Wright Corp. Propeller Div., Caldwell, N. J.
FATIGUE STRENGTH REDUCTION FACTORS FOR INCLUSIONS IN HIGH STRENGTH STEELS. [Period covered] May 1953 to October 1956. H. N. Cummings, F. B. Stulen, and W. C. Schulte. Sept. 1957. 38p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE STUDIES. Contract AF33(616)-5182. (AD-151162; PB-131816). $1.00(OTS).

Tentative values of fatigue strength reduction factors for nonmetallic nonmalleable inclusions in single-nucleus fractures of rotating-beam specimens are determined by two methods. Data for the computations are taken from tests on 309 specimens of SAE 4340 and 4350 steel, of 140, 190, 230, 260, and 300 ksi UTS. Quantitative results are thought to be somewhere near the correct order of magnitude. Qualitatively, it is concluded that the values of the factors depend upon the size of the inclusions and upon the hardness level of the steel. Also, it is thought that for very small inclusions (less than 0.00025 inch) other inhomogeneities inherent in the steel itself dominate the failure of a specimen. (auth)

3838 WADC-TR-57-662
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
THIN METAL FILMS AS CORROSION INDICATORS. Period covered: November 15, 1956 to November 15, 1957. Richard B. Belser and Frank E. Hankinson. Nov. 15, 1957. 97p. Project No. 7312. Contract AF33(616)-3879. (AD-155516).

In order to investigate the feasibility of using thin metal films deposited on glass or plastic substrates as integrating indicators of corrosive conditions, the corrosion rates of films of nine metals exposed to air atmospheres of controlled temperature and humidity have been studied. Of the metals iron, manganese, copper, nickel, cobalt, strontium, calcium, magnesium, and zinc, only films of iron and manganese proved worthy of more than a preliminary survey. A more intensive study of the corrosion properties and rates of iron and manganese films and of the bimetal pairs iron and copper and iron and gold was undertaken. This investigation disclosed the important role in metal film corrosion of the adsorbed gas layer normally present on glass substrates. This layer furnished the oxygen necessary for small particles of the oxides of iron to form at random sites in the film. These subsequently became elements of electrolytic cells in which the iron film acted as the anode in the presence of air at 25°C and 70 percent relative humidity. Destructive oxidation of the film thereafter proceeded by electrochemical processes. Rates of corrosion for iron films were controllable to a degree by removal of the adsorbed gas layer by pre-deposition heating of the substrate to 400°C or by more complete combination of the adsorbed layer with the metal of the film induced by post-deposition heating of the film. The former method reduced corrosion rates because of the removal of the oxygen supply for the formation of oxide nuclei, and the latter method increased the corrosion rate because of the greater number of oxide nuclei formed. Control of the corrosion rates of iron films under specific conditions of temperature and humidity appears feasible by control of the adsorbed gas layer and by introduction of cathodic particles either in the form of oxides or in the form of small volumes of a more electrically positive metal deposited at selected sites. (auth)

3839 WADC-TR-58-105
New York Univ., New York. Coll. of Engineering.
REINVESTIGATION OF THE SYSTEMS Ti–Al–Cr AND Ti–Al–V. Period covered: May 1, 1956 to November 30, 1957. July 21, 1958. 86p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3619. (AD-155850).

The Ti–Cr and Ti–V systems were investigated in the range of 2 to 36% Cr and 2 to 36% V in the temperature range 500 to 1150°C (Cr) and 500 to 900°C (V), with both iodide titanium and Bureau of Mines titanium as base material. Conventional and rapid-quenching techniques were employed. In the Ti–Cr system, the $\beta/\alpha+\beta$ boundary was lower than that generally obtained by conventional quenching. The β transus exhibited a change in slope at about 750°C for both iodide titanium and Bureau of Mines titanium. The β/β + TiCr boundary seemed to be shifted towards lower chromium content when the Bureau of Mines titanium was used as base. The eutectoid temperature was found to be between 660 and 670°C for iodide titanium base alloys. In the Ti–V system, the $\beta/\alpha+\beta$ boundary was in agreement with most of the earlier determinations. Below 650°C it was found to be greatly obscured by the presence of an impurity phase. Five tentative isothermal sections of the titanium-rich corner (up to 40% Al and 32% Cr) of the Ti–Al–Cr system were constructed at 200° intervals between 600 and 1400°C. The titanium-rich corner of the Ti–Al–V system was investigated in the region up to 45 wt. % Al and up to 35 wt. % V and between 700 and 1400°C. Eight isothermal sections at 100° intervals are presented. The phases encountered in this region were those which have been identified as being present or probably present in the binary Ti–Al system, namely, α, β, ϵ, Ti_2Al, and TiAl. (auth)

3840 WADC-TR-58-182
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEVELOPMENT OF A HEAT TREATABLE TITANIUM SHEET ALLOY. Period covered: January 1, 1956 to December 31, 1957. C. Robert Lillie and David W. Levinson. Mar. 1957. 93p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3320. (AD-155796).

The objective of this research program was to develop heat-treatable titanium sheet alloys capable of providing 160,000-psi yield strength, 0.2% offset, at room temperature. The material should be easily rolled to light gages, of the order of 0.020 in., possess excellent formability in the solution-treated condition, and be stable under stress, as heat treated, for at least 500 hours at 600 and 800°F. Good weldability was secondary in desirability to the foregoing requirements. The program was divided into two parts. Phase I had as its purpose the screening of fifteen alloys in order to select the four most promising for more intensive investigation in Phase II. Of the fifteen alloys, four were of the alpha-beta type, utilizing the strengthening effect of a precipitation-hardener, beryllium; seven alloys were alpha-beta type, based on well-known successful combinations of aluminum with the beta-formers, manganese, molybdenum, and vanadium, and dependent for strengthening on the substitution of the alpha-formers, tin or zirconium, for part of the aluminum; the remaining

three alloys were of the metastable-beta type, containing 2.5% aluminum for alpha strengthening, and sufficient amounts of manganese, molybdenum, or vanadium to produce a mechanically unstable beta phase after suitable heat treatment. The optimum heat treatments for each of these alloys were determined by bend test screening to establish the best solution-treating temperatures, followed by an aging program to fix the temperatures and times of aging which yielded promising hardness values. These combinations of solution treatment and aging were then checked out by tensile testing. The four alloys selected for work under Phase II were: Ti–3Al–7Mo–0.25Be, Ti–3Al–2Sn–4Mn, Ti–2Al–2Sn–7Mo, and Ti–2.5Al–7Mn. In Phase II of the program these four alloys were evaluated by bend testing and tensile testing, by measurement of uniform elongation in the solution-treated condition, and by stress stability testing for 500 hr at 800 and 600°F. Two alloys, Ti–3Al–7Mo–0.25Be and Ti–2.5Al–7Mn, reasonably fulfilled the objectives of the program with regard to bend properties and tensile properties, and were stable under a stress of 25,000 psi for 500 hours at 800°F; however, neither alloy is weldable. (auth)

3841 WADC-TR-58-203

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

PROTECTIVE COATINGS FOR TANTALUM. [Period covered] March 1957 to March 1958. C. Arne Arenberg. May 20, 1957. 18p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3983. (AD-155717).

The feasibility of protective ceramic coatings for tantalum under high temperature and high air velocity conditions was studied. The method of coating that proved to be most practical was the "Flame Ceramics" process. Three test facilities, an oxy-acetylene cutting torch, a water stabilized arc plasma, and a liquid fuel rocket exhaust were used. None of the tests was completely valid since the shape factor of the test specimen, the time-temperature profile, and gas velocities were not realistic. The tests established by the Chicago Midway Laboratories using the proper geometry and feeding the specimen into the plasma at a predetermined rate constitutes a more realistic approach and should be applied to any future testing programs. The testing program established the feasibility of protective ceramic coatings for tantalum, and points up the importance of a heat sink, particularly at ultra-high temperatures. It particularly points to the need for additional research in this area. (auth)

3842 WADC-TR-58-269

Metcut Research Associates Inc., Cincinnati.

HIGH TEMPERATURE COATINGS FOR CHROMIUM HOT WORK TOOL STEELS. Period Covered: January 1957 to June 1958. Elwood B. Norris. July 28, 1958. 90p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-3916. (AD-203121).

Chromium hot work tool steels are normally useful to approximately 1000°F provided that they are protected from corrosive atmospheres. A typical 5% chromium tool steel, Thermold J, was used to study the protective qualities of various plated, dipped, or sprayed coatings. In addition to investigating the oxidation and corrosion protection, selected coatings were checked for their effect on tensile, stress-rupture, and fatigue properties of the base metal at room and elevated temperature. The relative resistance of the selected coatings to abrasion and thermal shock was also studied. From a corrosion standpoint, the best of the coatings investigated were nickel–zinc, Aluminizing, Alumicoat, and nickel. Of the selected coatings, Aluminizing and Alumicoat reduced the strength of the base metal because of the high temperatures encountered during coating. Aluminum–silicone paint was the only coating which did not significantly reduce the fatigue strength. Watts nickel had high thermal shock resistance. Electroless nickel had the best abrasion resistance. (auth)

3843 WADC-TR-58-328

New York Univ., New York. Coll. of Engineering.

DEVELOPMENT OF ACTIVE-EUTECTOID BASE ALLOYS. [Period covered:] January 1, 1957 to December 31, 1957. R. F. Bunshah and H. Margolin. Aug. 1, 1958. 43p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3942. (AD-202501).

Titanium–copper alloys form an active eutectoid titanium alloy system in which the decomposition of the beta phase to alpha plus compound occurs rapidly. This alloy development program is a study of the effect of stepwise additions of Al and/or Sn and/or Zr to binary Ti–2Cu, Ti–4Cu, and Ti–6Cu alloys. The alloys were forged as far as possible in the $\alpha + \beta$ field and annealed at 750°C for 24 hours to alpha plus compound. The alloys were evaluated by tensile tests at room and elevated temperatures. Limited stress-rupture and stability tests were also carried out. Several alloys showed excellent tensile properties particularly in the range 1000 to 1200°F. A Ti–6Cu–7Al–6Zr alloy was outstanding, showing a tensile strength of 108,900 psi at 1200°F. These alloys show promise of utility in the 1000 to 1200°F range. Instability apparently associated with the Ti–Al phases was encountered. (auth)

3844 WAPD-PMM-61

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ALUMINUM ALLOYS SUITABLE FOR USE IN HIGH TEMPERATURE WATER. Report No. 1. R. K. McGeary, J. Belle, and B. Lustman. Aug. 12, 1955. 11p. $3.30(ph OTS); $2.40(mf OTS).

Aluminum alloys were tested in water at 500 to 680°C and in steam at 680°C. The effects of temperature and time were evaluated in static and dynamic tests. In addition, the oxide scale was examined by x-ray-diffraction, and the amount of aluminum lost by corrosion was measured. Included in the evaluations were aluminum–copper alloys and other aluminum alloys containing less than 1% of such elements as nickel, iron, silicon, magnesium, manganese, vanadium, and zirconium. (J.R.D.)

3845 WAPD-TM-101

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

RÉSUMÉ OF URANIUM OXIDE DATA—XI. J. Belle and L. J. Jones. Jan. 15, 1958. Includes papers: RÉSUMÉ OF URANIUM OXIDE INVESTIGATIONS. C. M. Schwartz, D. A. Vaughan, and J. R. Bridge; STUDIES CONCERNED WITH URANIUM DIOXIDE AT THE KNOLLS ATOMIC POWER LABORATORY. A. P. Beard; CONTRIBUTION FOR THE UO_2 PANEL SPONSORED BY W.A.P.D. FOR FEBRUARY 5, 1958. H. S. Parker. 69p. Contract AT-11-1-GEN-14. $10.80(ph OTS); $3.90(mf OTS).

The preparation and characterization of UO_2 powders

and the effects of ball-milling and steam on the sintering of UO_2 are discussed. Investigations of UO_2 stability in water, UO_2–O_2 equilibrium and kinetics, O_2 diffusion in UO_2, and the inert gas fission products of UO_2 are also reported. In the UO_2 irradiation program, fusion and grain growth in UO_2 and the effect of high burnup on PWR blanket rods were studied. Reports of studies conducted at KAPL on sintering binary UO_2 mixtures with CeO_2, ZrO_2, Nb_2O_5, and PuO_2 and studies at BMI on the effect of structure and N_2 content on UO_2 prepared from various sources are presented. (A.C.)

3846 WAPD-TM-141
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PICKLING OF THE ZIRCALOYS PRIOR TO CORROSION EXPOSURE. S. Kass, D. J. Fontanese, A. E. Oaks, and D. B. Scott. Sept. 1958. 65p. Contract AT-11-1-GEN-14. $1.75(OTS).

A series of investigations relative to the pickling of the Zircaloys prior to corrosion exposure is described. The feasibility of utilizing common ion neutralization, and sulfuric acid rinses subsequent to pickling to facilitate surface cleaning and minimize acid entrapment was investigated. Investigations of various addition agents to the aqueous nitric acid–hydrofluoric acid pickling solutions were made to evaluate pickling rates, surface smoothness, ease in rinsing, and effects upon subsequent corrosion properties. The corrosion evaluations of a hydrochloric acid–hydrofluoric acid etchant and nitric and sulfuric acid–hydrofluoric acid solutions were made. (auth)

3847 AEC-tr-3497
OBTAINING OF SOLID LAYERS OF URANIUM, NEPTUNIUM, PLUTONIUM AND AMERICIUM BY ELECTROLYTIC DEPOSITION. (Polucheniye Prochnykh Sloyev Urana, Neptuniya, Plutoniya i Ameritsia Metodom Electroliticheskogo Osazhdeniya). G. I. Khlebnikov and E. P. Dergunov. Translated by Lydia Venters (Argonne National Lab.) from Atomnaya Energ. 4, 376-7(1958). 4p.

The technique for the preparation of tough thin layers of U, Pu, and Np is presented. Conditions of electrolysis are described as well as preparation of the electrolyte and treatment of the target. (auth)

3848 AEC-tr-3509
X-RAY INVESTIGATIONS OF TITANIUM, ZIRCONIUM, VANADIUM AND TANTALUM HYDRIDES. (Rontgenuntersuchungen über die Hydride von Titan, Zirkonium, Vanadin und Tantal). Gunnar Hägg. Translated for Oak Ridge National Lab. from Z. physik. Chem. (Leipzig) 11B, 433-54(1930-1931). 30p.

The hydrides of Ti, Zr, V, and Ta were investigated by x rays. Several hydride phases which all showed a simple crystal construction were found for Ti, Zr, and Ta. Hydride samples of V did not result in usable photographs due to inhomogeneties. The hydrogen atom showed a mean radius value of 0.46 A. (auth)

3849 AEC-tr-3517
CALCULATION OF THE LIMITING VALUES OF THE ACTIVATION ENERGY FOR DIFFERENT PROCESSES IN SOLID METALS. K. A. Osipov. Translated by S. J. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 121, 637-9(1958). 5p.

A previously developed hypothesis states that the activated state in self-diffusion, recovery and recrystallization, plastic deformation and fracture, dislocation motion, and viscous flow along the grain boundaries is virtually the same. On this hypothesis the limiting values of the activating energy for these processes are calculated and compared with experimental values. (T.R.H.)

3850 AEC-tr-3518
ON THE INFLUENCE OF IRREVERSIBLE STRUCTURAL CHANGES ARISING DURING PLASTIC DEFORMATION ON THE DIFFUSIONAL NOBILITY. S. Z. Bokshtein, T. I. Gudkova, A. A. Zhukovitskii, and S. T. Kishkin. Translated by S. J. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 121, 1015-18(1958). 6p.

The effect of preliminary high-temperature plastic deformation on volume and grain-boundary diffusion of Sn in Ni is investigated. The results indicate that preliminary deformation increases significantly both volume and grain-boundary diffusion rates of Sn in Ni. (T.R.H.)

3851 AEC-tr-3519
ON THE SELF-DIFFUSION ACTIVATION ENERGY IN LIQUID METALS. K. A. Osipov. Translated by S. J. Rothman (Argonne National Lab.) from Doklady Akad. S.S.S.R. 121, 1019-20(1958). 3p.

Experimental thermodynamic data are plotted for Na, Sn, Al, Mg, Pb, and Fe to show that the activation energy of self diffusion in metals near the melting point is equal to activation energy referred to one atom minus latent heat of melting. (T.R.H.)

3852 CEA-tr-A351
LE MOLYBDÈNE DANS LES ACIERS ET LES ALLIAGES RÉSISTANT AUX AGENTS CHIMIQUES. (Molybdenum in Steels and Alloys Resistant to Chemical Reagents.) L. Wetternik. Translated by A. Courtot from Werkstoffe u. Korrosion 7, 628-33 (1956). 21p.

The effect of molybdenum additions on the chemical resistivity of various steels and alloys was investigated. Cr steels, Cr–Ni steels, Ni–Fe alloys, Fe–Ni–Cu alloys, Fe–Cr–Ni–Cu alloys, and Fe–Si systems were studied. The results as a function of increasing Mo content are graphed. The resistance of pure molybdenum to various chemical reagents was determined. (J.S.R.)

3853 CEA-tr-A446
ESSAI DE CORROSION INTERCRISTALLINE POUR DES ACIERS AUSTENITIQUES NICKEL–CHROME SOUDÉS ET NON SOUDÉS. (Test of the Intercrystalline Corrosion for Welded and Non-welded Nickel–Chromium Austenite Steels.) Herbert Ziher. Translated by Mme. Henry from Arch. Eisenhüttenw. 28, 410-16(1957). 71p.

A comparison is made of the different test methods for the investigation of intercrystalline corrosion. Characteristic isotherm curves of the precipitation of carbon at the grain boundaries are given. The differences between the tests in hydrofluoric acid–nitric acid mixtures, copper sulfate–sulfuric acid mixtures, nitric acid, and oxalic acid are presented. The effect of heat during welding was measured. A comparison was made of the energy distribution of welding for austenitic and ferritic metal sheets. The characteristic curves of precipitation were determined as a function of the welding conditions. (J.S.R.)

3854 CEA-tr-R502
MÉTHODE D'ESSAIS DE LONGUE DUREE A HAUTE TEMPERATURE D'ÉCHANTILLONS TUBULAIRES SOUS PRESSION INTERNE D'HYDROGÈNE. (Method

for the Long-Time Testing at High Temperatures of Tubular Samples under Internal Pressure of Hydrogen.) Kolgatin (Kolgatine), Glikman, and Teodorovich (Theodorovitch). Translated by I. Melnick from Zavodskaya Lab. 23, 1098-1101(1957). 15p.

The effect of internal pressure, caused by hydrogen for example, on the longitudinal resistance of tubular samples was studied. The special installation designed and the experimental method used to study this problem are described. Experimental results obtained with several steels are presented. (J.S.R.)

3855 CEA-tr-R503

MEASURE DE LA PROFONDEUR DE PENETRATION ET DU COEFFICIENT DE DIFFUSION DU GAZ DANS LE METAL. (Measurement of the Depth of Penetration and of the Coefficient of Diffusion of Gas in Metal.) A. M. Rodine and S. A. Koutchai. Translated by I. Melnick from Pribory i Tekh. Ekspt. No. 4, 68-9 (1957). 6p.

Expressions for the depth of penetration L and the coefficient of diffusion D of gas in metal are derived. The derivation is based on the determination of the degasification of each face of a metal plate during measurement of the total degasification of the sample. (J.S.R.)

3856 CEA-tr-R511

DETERMINATION SOUS VIDE DE LA CONDUCTIVITÉ ELECTRIQUE DES MATERIAUX RÉFRACTAIRES À DES TEMPERATURES ALLANT JUSQU'À 2,200°C. (Determination under Vacuum of the Electric Conductivity of Refractory Materials at Temperatures up to 2,200°C.) A. N. Lulichev (Lulitchev), F. J. Chuprynin (Tchouprynine), and S. I. Kovalenko. Translated by I. Melnick from Zavodskaya Lab. 23, 931-4(1957). 8p.

The method and the apparatus used for the measurement of the electric conductivity of refractories in a vacuum for temperatures up to 2,200°C are described. Some results obtained with Al_2O_3, MgO, and ZrO_2 are given, and they show that the measurements are reproducible. (J.S.R.)

3857 NP-tr-205

PRODUCTION OF FILMS OF ALLOYS OF VARIABLE COMPOSITION. G. A. Kurov. Translated for MIT from Pribory i Tekh. Ekspt. 3, No. 5, 99-101(1958). 7p.

A metal vacuum apparatus for producing samples of alloys of variable composition is described. Very thick layers of alloys of 40 to 50 μ and greater can be obtained. An evaporator in the form of a pipe with a slot along the generator is used. The equal-composition line in the samples obtained is straight. (auth)

3858 SCL-T-213

A FRENCH TECHNIQUE OF CERAMIC CUTTING TOOLS. L. Gion and L. Perrin. Translated by Marcel I. Weinreich (Sandia Corp.) from Machine Mod., 9-12(Aug. 1957). 7p.

A review of the production and properties of modern ceramic materials is presented. These materials, called fritted oxides, are compared with the classical ceramics, and it is pointed out that the fritting technique can be extended to other materials such as carbides and nitrides, as well as certain metallic bodies. The process occurring in the course of the fritting is illustrated by the steps in the manufacture of alumina ceramic cutting tools. In some respects, the sintered mass is superior to the unique crystal because the absence of a preferred orientation in the magma of crystals precludes all possibility of breaking along the planes of cleavage. (J.R.D.)

3859

EFFECT OF A CERAMIC COATING ON THE CREEP BEHAVIOR OF SOME HIGH-TEMPERATURE ALLOYS. John R. Cuthill, Joseph C. Richmond, and Nancy J. Tighe (National Bureau of Standards, Washington). Am. Ceram. Soc. Bull. 38, 4-12(1959) Jan.

Creep tests were conducted on both uncoated and ceramic-coated sheet metal specimens of type 310 stainless steel and of two commercial 80Ni-20Cr type alloys at 1800, 1900, and 1975°F. Other constant load tests were conducted at 1900 and 1975°F., in which only the total extension was measured after the completion of the test. All tests were of 100 hours duration. The coating was NBS ceramic coating N-143. The ceramic coating was found to markedly decrease the creep or extension in most cases but the coating appeared to have a detrimental effect at certain combinations of temperature and stress. (auth)

3860

HOW UO_2 FUEL CORES ARE EXTRUDED. D. R. Stenquist and R. J. Anicetti (General Electric Co., Richland, Wash.). Ceram. Ind. 71, No. 4, 102-3(1958) Oct.

Extrusion techniques developed for fabricating high-density UO_2 fuel cores are described. A number of UO_2 powders were satisfactorily extruded and sintered into high-density $\frac{1}{4}$- to $\frac{3}{4}$-inch rods in continuous lengths up to six feet. The advantages of extrusion over other processes are discussed. (W.D.M.)

3861

FINE CRYSTALLINE STRUCTURE OF SOME NICKEL ALLOYS. V. G. Chornii (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Dodatok do Ukrain. Fiz. Zhur. 2, No. 2, 73-5(1957). (In Russian)

Alterations in the fine crystalline structure and mechanical properties of nickel–chromium alloys with admixtures of Al and Ti were investigated at 400 to 800°C. (R.V.J.)

3862

GRAPHITIZATION ON THE Fe–C ALLOY SURFACE IN THERMAL TREATMENT IN VACUUM. I. I. Pyasetskii (Dnepropetrovsk State Univ.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 2, 139-43(1958). (In Russian)

Results are presented of an investigation of the behavior in a vacuum of steel surfaces, taken over a wide range of carbon concentration, depending on the composition and rate of cooling. The behavior of pre-eutectic white iron surfaces was also studied on crystallization, cooling, and isothermal holding. It is shown that in all cases of thermal treatment in a vacuum the process of graphite formation on the surface proceeds at a considerably greater rate than in the solid matrix. On these grounds, it is inferred that numerous microscopic defects (pores, fissures, etc.) play a great part in the formation of graphitization centers. (tr-auth)

3863

INVESTIGATION OF ZIRCONIUM BORIDE–MOLYBDENUM SYSTEMS. M. S. Kovalchenko, V. S. Neshpor, and G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 7, 740-2(1958). (In Russian)

Investigations were made of a ZrB_2–Mo system obtained by sintering. A hypothetical ZrB_2–Mo system diagram was obtained by means of visual thermal, metallographic, and roentgenographic analyses and by

measuring the micro- and macrohardness. The existence of a tertiary boride, Mo_2ZrB_2, was found in the system. (tr-auth)

3864

MAGNETIC SUSCEPTIBILITY OF SOLID SOLUTIONS OF SOME METAL-LIKE COMPOUNDS. G. V. Samsonov, V. S. Neshpor, and N. S. Strelnikova (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 8, 838-40(1958). (In Russian)

Investigations were made of the magnetic susceptibility of solid solutions of NbC–ZrC, TaC–NbC, TaB_2–ZrB_2, and TiC–TiN by the relative method, taking the susceptibility of one of the components as unity. An attempt is made to explain the dependence of the magnetic susceptibility on the concentration in these alloys. (tr-auth)

3865

ON THE SINTERING OF TERNARY METAL POWDER MIXTURES. B. Ya. Pines and A. F. Sirenko (Gor'kii Kharkov State Univ.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 261-7(1958). (In Russian)

The dependence of shrinkage and stability limits of metal powder mixtures (Cu + Ni + Fe with 60% Cu + 70% Fe and 60% Ni + 40% Fe in quantities from 0, 20, 40, 60, 80, and 100%) on the concentration, during sintering, was determined. (tr-auth)

3866

EFFECTS OF THERMOMECHANICAL TREATMENT ON THE IMPACT VISCOSITY OF ALLOYED CONSTRUCTION STEELS. E. N. Sokolkov, L. V. Smirnov, and S. N. Petrova (Inst. of Metal Physics, Urals Branch of Academy of Sciences, USSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 276-80(1958). (In Russian)

Tests were made of the effects of the thermomechanical treatment during deformation by forging at 1150°C. (R.V.J.)

3867

EFFECTS OF PRELIMINARY COLD DEFORMATION ON CREEP. G. I. Nosova and V. M. Rozenberg (Central Research Inst. of Ferrous Metallurgy). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 321-5(1958). (In Russian)

Effects of preliminary deformation on the creep in solid solutions of Cr–Co–Fe–Ni, with varied content of Co, at elevated temperatures were investigated. (R.V.J.)

3868

THE GRAIN SUBSTRUCTURE OF DEFORMED ALUMINUM–MAGNESIUM ALLOYS. V. I. Syutkina and E. S. Yakoveleva (Inst. of Metal Physics, Urals Branch of the Academy of Sciences, USSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 326-33 (1958). (In Russian)

A complex substructure consisting of large disoriented regions and weakly disoriented tiny blocks were found in the grains of deformed aluminum–magnesium alloys. It is shown that alloying with magnesium reduces the size of the tiny blocks and increases the number and degree of disorientation in the large disoriented areas. The effects of magnesium on the substructure are related to the magnesium atom blocking the distorted lattices and to the increase of heterogeneous intensities in the grain. (tr-auth)

3869

STUDIES OF FINE STRUCTURE IN SOLID SOLUTIONS OF ALUMINUM WITH MAGNESIUM AND NICKEL WITH COPPER. N. I. Noskova and V. A. Pavlov (Inst. of Metal Physics, Urals Branch of the Academy of Sciences, USSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 334-8(1958). (In Russian)

The statistical and dynamic distortions and the blocking in the deformation state were measured, as well as the statistical distortions in the solid solutions of Al–Mg and Cu–Ni. (R.V.J.)

3870

EFFECTS OF ALUMINUM, NITROGEN, BORON, AND TITANIUM ON SOME PROPERTIES OF STEEL. L. L. Pyatakova and Ya. E. Gol'dshtein (Chelyabinsk Polytechnic Inst.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 347-53(1958). (In Russian)

Effects of nitrogen and boron additions to liquid steel and some properties of boron steel are investigated. Applications of titanium in such types of steel are discussed. (R.V.J.)

3871

DIFFUSION IN NICKEL BASE LIMITED SOLID SOLUTIONS. A. Ya. Shinyaev (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 450-5(1958). (In Russian)

The effects of alloying elements on the diffusion processes in saturated, nickel base solutions of Ni–Ti, Cr–Ni–Ti, and Al–Cr–Ni–Ti–W at 950 to 1250°C were studied. The energy of diffusion process activation increases from pure nickel to the binary Ni–Ti, ternary Cr–Ni–Ti, and quintuple Al–Cr–Ni–Ti–W alloys. (R.V.J.)

3872

STUDIES OF Fe–Ni–Al METAL CERAMIC ALLOYS. A. B. Al'tman. Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 456-65(1958). (In Russian)

Three stages were observed in the sintering of Al–Fe–Ni alloys: the reduction of oxides with an increased metallic contact between compressed particles and exchange and recrystallization of particles in the first stage; in the second, the intersolubility of particles, diffused solidification of the obtained solid solution, and growth of the specimens; and in the third, homogenized and diffused hardening of solid solutions, growth of grains, and shrinkage of specimens. It was shown that there is no connection between shrinkage of the alloy and the liquid phase in sintering. (R.V.J.)

3873

INVESTIGATIONS OF $\gamma \rightarrow (\gamma + \alpha)$ PHASE TRANSITIONS IN IRON–NICKEL ALLOYS. M. I. Zakharov, I. A. Ignatova, and N. A. Khatanova (Lomonosov, Moscow State Univ.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 475-9(1958). (In Russian)

The phase transition $\gamma \rightarrow (\gamma + \alpha)$ was studied in iron alloys with 30 to 32% nickel. It is shown that at 400°C the transition process is exceedingly slow, at room temperature the cold deformation speeds up the $\gamma \rightarrow \alpha$ process, and at –196°C it accelerates the reverse transition $\gamma \rightarrow \alpha$. At a tempering temperature of 400°C, the coherence of the matrix is disturbed at the initial stage of the transition, slowing up the process. Further development of the α phase takes place by diffusion. (R.V.J.)

3874

MEASUREMENTS OF BLOCKS AND DEFORMATIONS IN THE SECOND TYPE α AND γ PHASES IN

ANNEALED CHROMIUM STEEL TEMPERING. Z. K. Kos'ko (Dnepropetrovsk Metallurgical Inst.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 480-2(1958). (In Russian)

Changes in the fine crystalline structure in carbide transitions from one composition to the other were studied. The strongest deformations in the second type crystalline lattices, in α and γ phases, take place with the appearance of the special carbide. The separation of the carbide is followed by the crushing of blocks and by the sharp drop of deformations in the lattice of α and γ solid solutions. (tr-auth)

3875

EFFECTS OF PHOSPHORUS AND NICKEL ON THE COLD SHORTNESS OF MEDIUM CARBON STEEL. V. N. Svechnikov and Yu. E. Yakovchuk (Kiev Polytechnic Inst.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 505-11(1958). (In Russian)

The effects of phosphorus and nickel on the cold shortness of 0.50% carbon steel were studied. The impact ductility of carbon, phosphorus carbon, and nickel alloyed steel at various temperatures and the microstructure of nickel alloyed steel were investigated. (R.V.J.)

3876

TENSITY RELAXATION IN NICKEL–COPPER ALLOYS. M. G. Gaidukov and V. A. Pavlov (Inst. of Metal Physics, Ural Branch of Academy of Sciences, USSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 517-21(1958). (In Russian)

Relaxation diagrams are presented for Cu–Ni alloys at 500, 550, 600, and 650°C with 10, 20, 40, and 60% Cu. (R.V.J.)

3877

SPECTRAL ANALYSIS OF THE Cu–Ni EQUILIBRIUM DIAGRAM AT ELEVATED TEMPERATURES. II. L. S. Palatnik, A. A. Levchenko, A. F. Bogdanova, and V. E. Terletskii (Gor'kii Kharkov State Univ.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 540-4 (1958). (In Russian)

Data are presented from the spectral analysis of liquid–vapor equilibrium of metallic alloys at elevated temperatures. (R.V.J.)

3878

EFFECTS OF TEMPERING ON THE PHASE COMPOSITION ON IRON SURFACES ELECTRICALLY HARDENED BY VARIOUS METALS. B. P. Kolesnik (Inst. of Ferrous Metallurgy, Academy of Sciences, Ukrainian SSR). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 566-8(1958). (In Russian)

Effects of tempering on the phase composition and microhardness of surface layers of nine iron specimens electrically hardened with Al, Cu, Fe, Mn, Nb, Ni, V, Zr, and graphite were investigated. It is shown that tempering induces considerable changes in the phase composition and microhardness in specimens treated with Mn, Fe, and Cu. The changes in specimens treated with graphite, V, Zr, and Nb were slight, while in the specimens treated with Al and Ni the changes were noticeable but not as pronounced as in the first group. (R.V.J.)

3879

EFFECTS OF ALUMINIUM ON THE PROPERTIES OF IRON–CHROMIUM–NICKEL–MANGANESE ALLOYS. K. V. Gorev and L. I. Shvedov (Inst. of Physics and Tech., Academy of Sciences, Belorussian SSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 6, 45-9(1958) June. (In Russian)

Tests were made of hardness and relative heat resistance of Cr–Fe–Mn–Ni alloys with admixtures of Al. It is shown that with 12% Ni (and over) and with 3% Al (and over) the alloys have tendencies to dispersion hardening and increased heat resistance. (tr-auth)

3880

MECHANICAL PROPERTIES OF ALUMINIUM AFTER PRELIMINARY PLASTIC DEFORMATION AT HIGH HYDROSTATIC PRESSURES. B. I. Beresnev, L. F. Vereshcagin, and Yu. N. Ryabinin (Physics Inst. of Metals, Sverdlovsk). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 9, 119-22(1958) Sept.

The extrusion of aluminum under all-round hydrostatic pressure makes it possible to study the effect of pressure during preliminary deformation on factors determining the strength of the deformed metal. Where the degree of preliminary deformation of the metal is $\psi = 0.562$, no effect of pressure on these factors was discovered. With an increase in the degree of preliminary deformation to $\psi = 0.754$, the strength of the deformed metal increased somewhat with an increase in pressure. (tr-auth)

3881

HOW NICKEL AFFECTS HIGH-SPEED TOOL STEELS. R. F. Hehemann and A. R. Troiano (Case Inst. of Tech., Cleveland). Iron Age 182, No. 26, 52-6(1958) Dec. 25.

The affects of nickel on annealing of high-speed tool steel are discussed. Some of the advantages that might accrue from the addition of nickel to high-speed steels include improved ductility, resistance to shock loading, and other general benefits associated with nickel-containing structural steels. When the same austenizing temperatures are used for nickel-containing grades, relatively large amounts of austenite may be retained. However, the retention of austenite in these steels can be controlled by a proper choice of austenizing temperature. A combination of metallographic and x-ray-diffraction techniques was used to determine the influence of austenizing temperature on the structural state of the nickel-modified steels. The results are graphically shown. (A.C.)

3882

DETERMINATION OF IRON AND CHROMIUM DIFFUSION PARAMETERS IN Fe–Cr ALLOYS. L. I. Ivanov and N. P. Ivanchev (Inst. of Physics, Academy of Sciences, Bulgaria). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 8, 15-18(1958) Aug. (In Russian)

The parameters of iron and chromium diffusion in a series of α phase alloys at temperatures above the σ phase separation temperatures are determined. (R.V.J.)

3883

STRUCTURAL ALTERATIONS IN Cr–Ni ALLOY CREEP. G. Ya. Kozyrskii, V. A. Kononenko, and P. N. Okrainets (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 8, 90-2(1958) Aug. (In Russian)

Results are presented of the x-ray diffraction and metallographic analyses of prepared specimens of 80.2% Ni–19.8% Cr. Structural deformations at various temperatures and strain rates are given. (R.V.J.)

3884

INFLUENCE OF THORIUM ON THE HEAT RESISTANCE OF MAGNESIUM AND ITS ALLOYS. M. E. Drits, M. V. Mal'tsev, E. M. Padezhnova, and Z. A. Sviderskaya. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 8, 93-6(1958) Aug. (In Russian)

The hardness of magnesium–thorium alloys and triple alloys of thorium–magnesium with cerium, manganese, aluminum, calcium, and zinc were measured and results tabulated. The microstructure and thermal analyses showed that magnesium with thorium forms a eutectic type diagram. The eutectic consists of α solution crystals and Mg_2Th(Mg_5Th) compounds with 40 to 42% Th concentration, melting at 580°. (R.V.J.)

3885

DIFFUSION IN ALUMINUM–CHROMIUM–NICKEL–TITANIUM–TUNGSTEN ALLOY. I. I. Kornilov and A. Ya. Shinyaev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk. No. 10, 96-9(1958) Oct. (In Russian)

Investigations were made of diffusion in prepared alloys with a constant content of 4.5% Al–20% Cr–6% W–1 to 9% Ti–bal. Ni. All specimens were subjected to a preliminary thermal treatment at 1200° for 4 hrs. The studies were made at 995, 1060, 1165, and 1250°C. Results are tabulated. (R.V.J.)

3886

POLYGONIZATION OF CAST METALS AND ALLOYS. B. A. Movchan. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 10, 122-3(1958) Oct. (In Russian)

Studies were made of the microstructure of Ni–Fe (75 to 80 wt. %), Ni–Co (90 wt. %), Ni–W (30 wt. %), Cu–Al (8 wt. %), and other solid solution alloys with a narrow margin of hardening. The changes in the original crystalline shape were investigated at slow and rapid cooling rates (from the temperature of solidification) in order to determine the relationship between polygonization processes and the physico-mechanical properties of cast metals and alloys. (R.V.J.)

3887

OPTICAL PROPERTIES OF VARIOUS EVAPORATED RARE EARTH OXIDES AND FLUORIDES. G. Hass, J. B. Ramsey, and R. Thun (U. S. Army Engineer Research and Development Labs., Fort Belvoir, Va.). J. Opt. Soc. Am. 49, 116-20(1959) Feb.

To furnish a greater choice of film materials for application in optical multilayer coatings, the optical properties of evaporated rare earth compounds such as Y_2O_3, La_2O_3, Pr_6O_{11}, Nd_2O_3, Sm_2O_3, Gd_2O_3, LaF_3, NdF_3, and CeF_3 were studied in the wavelength region from 0.22 to 2μ. The materials were evaporated from tungsten boats and condensed on glass and fused quartz substrates at various temperatures. The optical constants n and k were determined mainly from reflectance, transmittance, and true thickness measurements. The following oxides were found to be useful because of their low absorption in the visible: La_2O_3 with n ranging from 1.85 to 1.95 with increasing thickness, Pr_6O_{11} with n ranging from 1.92 to 2.05, also with increasing thickness, and Nd_2O_3 with n = 2.05 for films of sufficiently low absorption. LaF_3 (n = 1.60 and NdF_3 (n = 1.61) showed no appreciable absorption in the whole wavelength region studied; CeF_3 (n = 1.63), however, exhibited two weak absorption bands at 0.234 and 0.248 μ. All n values are given at a wavelength of 0.5μ and for unbaked films deposited at 300°C substrate temperature. The oxides condensed as almost amorphous films, whereas the fluorides developed fairly large grains as indicated by their sharp electron diffraction rings. All films were hard and showed excellent chemical and mechanical durability. (auth)

3888

PHASE COMPOSITION OF CHROMIUM NICKEL AUSTENITE STEEL WITH TITANIUM. V. I. Prosvirin. Metalloved. i Obrabotka Metal. No. 10, 2-5(1958) Oct. (In Russian)

Intermetallides of $(FeNi)_3$ Ti and titanium carbide, TiC, are formed in austenite steel by the presence of Ti. Analysis was made of the regularities in the titanium phases in steel. (R.V.J.)

3889

INCREASE IN TEMPERATURE IN CONSTRUCTION STEEL FORGING. M. P. Braun, N. I. Kon, and E. I. Mirovskii (Novo-Kramotovskii Machine Building Plant). Metalloved. i Obrabotka Metal. No. 10, 41-6(1958) Oct. (In Russian)

Experiments were conducted with nickel containing steel at 1150, 1200, 1250, 1280, and 1300°C. It was found that forging at 1150 to 1300° increases the grain of the steel, however, the grain is easily crushed by plastic deformation and thermal treatment. The temperature can be raised up to 1270 to 1280° for steel not containing Ni and to 1250 to 1260° with the presence of Ni before plastic deformation. Final forging temperature is 800°C. (R.V.J.)

3890

GRAIN BOUNDARY STRUCTURE AND HEAT RESISTANCE OF AUSTENITE STEEL. E. N. Sokolov, M. G. Lozinskii, and E. I. Antipova (Inst. of Metal Physics, Ural Branch of the Academy of Sciences, USSR). Metalloved. i Obrabotka Metal. No. 11, 19-25(1958) Nov. (In Russian)

Effects of grain boundary structure on the creep rate and heat resistance of austenite steel were investigated. It was found that changes in grain boundary structure induced by preliminary plastic deformation without recrystallization increased the heat resistance. The reduced creep rate is connected to the break in the plastic deformation along the austenite grain boundary. Strengthening of the steel was determined by the change in fine structure of the grain as a whole. (R.V.J.)

3891

EFFECTS OF TEMPERATURE AND PRELIMINARY THERMAL TREATMENT ON THE CONTINUOUS STABILITY OF CAST AND DEFORMATION ALLOYS. A. A. Bochvar, M. E. Drits, Z. A. Sviderskaya, and E. S. Kadaner (Inst. of Metallurgy, Academy of Sciences, USSR). Metalloved. i Obrabotka Metal. No. 11, 32-7 (1958) Nov. (In Russian)

The differences in the heat resistance of cast alloy and deformation alloy of 1.5% Mn, 0.5% Al, 0.3% Ca, and 84.2% Mg were studied at 150 to 600°C. (R.V.J.)

3892

HEAT RESISTANCE OF COMPLEX ALLOYED FERRITE. A. M. Borzdyka and A. V. Merlina (Central Research Inst. of Ferrous Metallurgy). Metalloved. i Obrabotka Metal. No. 12, 10-16(1958) Dec. (In Russian)

The microstructure and phase constitution of ferritic steels containing Cr, Si, Mn, Co, W, Mo, and Nb were studied between 750 and 1200°C. Room-temperature mechanical properties were also obtained. The complex alloyed ferritic steels have good mechanical properties

at all investigated temperatures. At 500° the heat resistance is as high as that of some perlite-type steels. Additions of Nb (0.4%) to chromium-tungsten steel further improve the creep resistance and strength of the steel. However, the presence of Nb reduces toughness at standard temperature and the tensile strength at elevated temperatures. (R.V.J.)

3893

SINTERING TEMPERATURE FOR METAL CERAMIC ALLOYS OF Fe–Ni–Al BASE. A. B. Al'tman. Metalloved. i Obrabotka Metal. No. 12, 17–20(1958) Dec. (In Russian)

The microstructure and physical properties of aluminum-cobalt-copper-iron-nickel alloys (10% Al, 12.5% Co, 6% Cu, 54.2% Fe, 17% Ni, and 0.3 Ti) were studied at elevated and standard sintering temperatures. (R.V.J.)

3894

DEFORMATION OF CASE HARDENED STEEL. Yu. M. Bogatyrev and V. P. Eremina (Central Research Inst. of Tech. and Machine Building). Metalloved. i Obrabotka Metal. No. 12, 35–41(1958) Dec. (In Russian)

The effects of temperature and rate of case hardening on deformation of steel were studied at 950, 1000, 1050, and 1100° at a hardening depth of 3.5 mm. Deformation of gears under thermal treatment is also investigated. (R.V.J.)

3895

OXIDATION OF NICKEL IN SULFUR DIOXIDE AT ELEVATED TEMPERATURES. V. V. Ipat'ev and D. V. Zheltukhin (Kirov Leningrad Academy of Tech. and Forestry). Metalloved. i Obrabotka Metal. No. 12, 42–5 (1958) Dec. (In Russian)

The oxidation of nickel in sulfur dioxide at 600 to 800° follows a parabolic law, scale formation is at the maximum at 800°, and the oxidation rate is much faster than in air. The scale formed has two phases, NiO and NiS. The scheme of oxidation is $3\ Ni + SO_2 = 2\ NiO + NiS$. (R.V.J.)

3896

TRANSMISSION ELECTRON MICROSCOPY OF BERYLLIUM. J. D. Baird, O. P. Hartree, and R. Phillips (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). Nature 182, 1660(1958) Dec. 13.

Thin films of beryllium in which it is possible to observe the arrangements of dislocations and other structural defects by transmission electron microscopy were prepared. Methods of preparation are given along with a discussion of the examinations. It is concluded that the grain boundaries consist of edge dislocations stacked normal to the basal plane. (J.R.D.)

3897

ROLLING AND ANNEALING TEXTURES OF BERYLLIUM AND HAFNIUM SHEET. J. H. Keeler (General Electric Co., Schenectady, New York). Trans. Met. Soc. AIME 212, 781–2(1958) Dec.

Beryllium sheet, cold rolled from 0.036 to 0.006 in., a reduction of 84%, exhibited a split texture with the $[10\bar{1}0]$ direction in the rolling direction. The same specimen annealed in vacuo for 1 hr at 1000°C showed no change in orientation. The deformation texture of 70% cold-rolled hafnium was similar to that of beryllium although the tilt about the rolling direction of about 15° was less. Hafnium sheet annealed in vacuo for 1 hr at 800°C or for 1 hr at 1000°C showed pole concentrations no longer in the rolling direction. (J.E.D.)

3898

PREFERRED ORIENTATION IN ROLLED URANIUM RODS. Melvin H. Mueller and Harold W. Knott (Argonne National Lab., Lemont, Ill.), Warren P. Chernock (Combustion Engineering, Inc., New York) and Paul A. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 212, 793–8(1958) Dec.

A study was made of preferred orientation in uranium rods rolled to various reductions at 300 and 600°C. The rods used for the 300°C final rolling were obtained from three groups which had been previously either rolled at 600°C, or rolled at 300°C and annealed at 550°C, or β treated. The rods used for the 600°C final rolling were obtained from material previously β treated. It was found that, regardless of the starting material, the orientation was the same if the reduction at 300°C was approximately 70% or greater. A considerable variation in orientation was observed in rods with lower reduction. The type of orientation developed by 600°C rolling is somewhat different from that obtained by 300°C rolling. The recrystallization texture in rods rolled at 300°C may be described as consisting of (010) and approximately (140) fiber-texture components. Thermal cycling and thermal-expansion data are also given for these rods. (auth)

3899

THE CONSTITUTION OF ZIRCONIUM–URANIUM ALLOYS CONTAINING OXYGEN OR NITROGEN. A. A. Bauer, G. H. Beatty, and F. A. Rough (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 801–8(1958) Dec.

The extent of the α-plus-β Zr region in the binary U–Zr system at 660°C was determined. The phase boundary occurs at 31 wt.% U. This determination is based upon a quantitative study of U–Zr alloys containing oxygen and nitrogen; the data were employed in extrapolating to zero oxygen and nitrogen content in order to determine the constitution of binary alloys. On the basis of the data obtained, revisions in the constitutional diagrams of the U–Zr and O–U–Zr systems are proposed. A partial N–U–Zr diagram is presented. (auth)

3900

THE CONSTITUTION OF DELTA-PHASE ALLOYS OF THE SYSTEM URANIUM–MOLYBDENUM–TITANIUM. A. A. Bauer, F. A. Rough, and J. Doig (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 862–8(1958) Dec.

The phase relationships occurring between the intermediate σ phases of the Mo–U and Ti–U systems were determined. A ternary cut, based upon studies of alloys ranging in composition from U-31.5 at. % Mo to U-34 at. % Ti, illustrating these relationships and inferred isothermal ternary sections are presented. (auth)

3901

ANNEALING TEXTURE IN A ROLLED AND ARTIFICIALLY NUCLEATED ALUMINUM SINGLE CRYSTAL. S. Kohara, M. N. Parthasarathi, and P. A. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 212, 875–81(1958) Dec.

A high-purity aluminum crystal was rolled to 80% R.A. on (110) plane in $[1\bar{1}2]$ direction. After rolling the strip still retained its initial orientation and the rolling texture was extremely sharp. After one side of the

rolled strip was rubbed with a fine abrasive in a random manner, the texture of this surface was quite random, and it remained fairly random after annealing for 5 sec at 350°C, when the thin surface layer was completely recrystallized. After annealing for 600 sec at 350°C, recrystallized grains grew through the whole thickness (0.010 in.) of the specimen. As a result of very selective growth, the recrystallized grains reaching the other side of the strip showed a sharp recrystallization texture consisting of four components corresponding to 40° rotations around the two [111] axes of the deformed crystal lying in the rolling plane. The boundary mobility of recrystallized grains quite accurately oriented in this way was anisotropic. It is probable that the anisotropy of the boundary mobility, as well as its orientation dependence in face-centered-cubic metals may be related to the variation with boundary structure of the rate of self-diffusion, or of the diffusion of impurity atoms, along the boundary. (auth)

3902

EFFECT OF PLASTIC FLOW ON DIFFUSION IN NICKEL–MOLYBDENUM ALLOYS. I. Ya. Dekhtyar and V. S. Mikhalenkov (Inst. of Metal Physics, Academy of Sciences, USSR). Ukrain. Fiz. Zhur. 3, 385-90 (1958) May–June. (In Russian)

Diffusion of cobalt into Mo–Ni alloys (6.5, 9.6, and 16.7 at.% Mo) was investigated at 950 to 1150°C. It was found that the coefficient of diffusion increases proportionally with the slow rates of flow; however, with high rates of flow the diffusion rate exceeds the flow rate. Excessive diffusion is due to the appearance of excessive concentrations of vacancies and the interactions of dislocations. The softening coefficient varies with both the temperature and Mo concentration. (R.V.J.)

3903

ON THE DETERMINATION OF DISTRIBUTION BY CONCENTRATIONS FOR ALLOYS OF HETEROGENEOUS METAL POWDERS. A. I. Raichenko (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 408-18(1958) May–June. (In Russian)

Functions of distribution by concentrations were found by means of x-ray analysis for copper-nickel powder bodies at different degrees of sintering. A comparison of the theoretical and experimental results reveals both similar and dissimilar features. The results of the study demonstrated that the irregularities in the mixture and the presence of porosity leads to a retardation of the homogenization process as compared to the theoretical prediction. (tr-auth)

3904

CHANGE IN THE FINE CRYSTALLINE STRUCTURE ON THE AGING OF CERTAIN HIGH-TEMPERATURE ALLOYS. G. V. Kurdyumov, I. A. Bildzyukevich, et al. (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 494-505(1958). (In Ukrainian)

The aging process in high-temperature alloys of the nimonic type was studied. Changes in the fine crystalline structure, the dimensions of the coherent x-ray scattering regions, and the constant crystal lattice were investigated. The state of the intermetallic phase resulting from dissociation was also studied. It was established that the rise in hardness with aging of the investigated alloys is due to the appearance of a large number of high-dispersion α'-phase particles, apparently coherent with the matrix, but not leading to the formation of microstress. (tr-auth)

3905

EFFECT OF SHORT ORDER ON THE RESIDUAL RESISTANCE OF NICKEL ALLOYS. I. Ya. Dekhtyar, S. G. Litovchenko, and D. A. Ursul (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 506-15(1958). (In Ukrainian)

The dependence of the residual resistance on the degree of short order of binary alloys with a nickel base (Ni_3Mn, Ni–Au with 6 atomic % of Au, Ni–Mo with 16 atomic % of Mo) was studied. In the case of the Ni–Mo alloy, with formation of the chemical compound Ni_4Mo, the existence of anomalies in the change of residual resistance of the α-solid solution was found in the temperature ranges 860 to 930°C and 1000 to 1060°C. It is assumed that the variability of the residual resistance in these temperature ranges is connected with the variability of the short order at these temperatures. (tr-auth)

3906

INVESTIGATION OF ATOMIC MOBILITY AT HIGH-TEMPERATURE AXIAL COMPRESSION IN FERRITE TYPE ALLOYS. I. Ya. Dekhtyar and V. S. Mikhalenkov. Ukrain. Fiz. Zhur. 3, 516-20(1958). (In Ukrainian)

The effect of plastic strain on the diffusion of iron was studied in a commercial KB-7 alloy of the ferrite type containing Cr, Mo, and W. The coefficients of diffusion were determined at temperatures of 900 and 1000°C by means of the radioactive isotope Fe^{59}, employing the absorption method and taking into consideration the correction for change of area of the specimen by deformation. (tr-auth)

3907

INVESTIGATION OF THE EFFECT OF SHORT ORDER ON THE ELECTRICAL RESISTANCE OF CERTAIN BINARY ALLOYS. A. G. Lesnik, S. G. Litovchenko, et al. (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 522-7(1958). (In Ukrainian)

The effect of short order on the electrical resistance of the binary alloys Cu_3Au (an ordering alloy), Al–Zn with 20 at.% of Zn (an aging alloy) and FeCr (an alloy with the formation of chemical compounds) were studied. A dependence of the residual resistance on the quenching temperature was obtained for FeCr (50% Cr). The residual resistance of the FeCr alloy decreases with an increase in the quenching temperature if the alloy was previously annealed for 5 hours at 1100°C, and remains constant if the alloy was previously annealed for 200 hours at 1100°C. (tr-auth)

3908

THERMODYNAMIC PROPERTIES OF LIQUID ALLOYS CONTAINING ALKALI METALS. A. F. Alabyshev, M. F. Lantratov, and A. G. Morachevskii. Uspekhi Khim. 27, 921-37(1958) Aug. (In Russian)

The thermodynamic properties of liquid metal alloys Na–Pb, K–Pb, Na–Hg, K–Hg, Cs–Hg, Na–Tl, K–Tl, Na–Sn, Na–Cd, Na–Zn were reviewed and the integral molar isobar-isothermal potentials and thermal transitions of the liquid systems are tabulated. (R.V.J.)

3909

VACUUM WELDING OF METALS. J. A. Stohr (Commissariat á l'Energie Atomique, Saclay, France) and J. Briola (Commissariat á l'Energie Atomique, Paris). Welding and Metal Fabrication 26, 366-70(1958) Oct.

Electronic vacuum welding equipment is presented. The apparatus consists of equipment for manipulating the workpiece, electrical supply circuit, continuously evacuated chamber, and an electron gun. Welds have been performed successfully on U, Zr, Be, and Al with this equipment. (W.L.H.)

3910

CHEMICAL AND ELECTROCHEMICAL ASPECTS OF CORROSION IN NUCLEAR REACTOR. G. H. Cartledge (Oak Ridge National Lab., Tenn.). Werkstoffe u Korrosion 9, 493–503(1958) Aug.–Sept. (In German)

The chemical and electro-chemical aspects of the corrosion of metals in reactors are considered. After a survey of the electro-chemical processes on the phase boundaries between metal protective films and the solutions under normal conditions, the influences of radioactive radiation on these processes and the corrosion reactions caused by the products of nuclear fission are discussed. Some results obtained at the Oak Ridge National Laboratory are considered. (auth)

3911

CORROSION OF ALUMINUM AND ITS ALLOYS IN WATERS OF DIFFERENT COMPOSITION. Otakar Sverepa and G. W. Akimow (Staatl. Forschungsinstitut für Materialschutz, Prague, Czechoslovakia). Werkstoffe u Korrosion 9, 533–6 (1958) Aug.–Sept. (In German)

Corrosion tests of aluminum and its alloys were made in river waters and in coolant waters of circulating systems carried out in natural conditions. In river water the corrosion was low and uniform, but there was pitting corrosion in circulating water. The composition and the impurities of the water influence the corrosion. The differences between the corrosion behavior of the different materials were slight. Laboratory tests showed that Al–Mn and Al–Mg alloys undergo the most intensive corrosion by the mutual action of Cu^{2+}, Cl^-, Ca^{2+}, and HCO_3^- in the presence of oxygen. Pitting corrosion depends largely on the concentration of the ions mentioned. Other cations and anions cause less pitting. The weight loss, the number of pits on the surfaces, the maximum corrosion depth, and the nature of the corrosion products were determined as functions of the concentration of Cu^{2+}, Cl^-, and $Ca(HCO_3)_2$, and the pH value. (auth)

3912

CHANGES OF THE SATURATION MAGNETIZATION AND THE ELECTRICAL RESISTANCE OF IRON–NICKEL ALLOYS UPON UNIFORM COMPRESSION AT LOW TEMPERATURES. E. I. Kondorskii and V. L. Sedov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 845–53(1958) Oct. (In Russian)

A study was made of changes in the saturation magnetization and electrical resistance of the binary iron–nickel alloys, containing 38 and 45% nickel, under the influence of pressure created by freezing water in a bomb. The measurements were carried out in the temperature interval from 1.7 to 77°K and in fields up to 7000 gauss. The extreme values of saturation magnetization and electrical resistance for $T \to 0$ were found to vary upon uniform compression, the signs of these changes being different. The indicated limiting values also change with the growth or decrease of the field at high magnetic field strengths, and for $T \to 0$ the differential magnetic susceptibility in the region of magnetic saturation does not vanish. The relationship between the variation of the limiting values of the saturation magnetization and electrical resistance induced by pressure or by the field are found to be close. (tr-auth)

3913

INTERACTIONS OF FeS WITH TiO_2 IN PRESENCE OF CARBON. Zh. L. Vert and M. V. Kamentsev (All-Union Research Inst. of Abrasives). Zhur. Neorg. Khim. 3, 1200–4(1958) May. (In Russian)

Studies were made of TiO_2–FeS interactions in presence of carbon and other components (Al_2O_3, SiO_2, and CoO). The formation of titanium sulfide (as a solution in FeS) begins at 1300°C. Separate phases of titanium sulfide were not observed. Increases in temperature increase the yield of titanium sulfide. On saturation with carbon TiS_2 combines into carbide, followed by desulfonation of the charge. Additional admixtures of Al_2O_3 or $Al_2O_3 + Fe_2O_3$ did not affect the yield of titanium sulfides. (R.V.J.)

3914

CONSTITUTION DIAGRAMS OF CHROMIUM–MOLYBDENUM–TUNGSTEN. I. MICROSCOPIC AND X-RAY DIFFRACTION STUDIES. N. V. Grum-Grizhimailo and D. I. Prokof'ev. Zhur. Neorg. Khim. 3, 1220–6(1958) May. (In Russian)

Phase studies and structures of the Cr–Mo–W alloys were studied in a wide range of component concentrations. The isothermal cross sections of the total triangle of concentrations at 1800, 1300, and 1000°C were investigated. (R.V.J.)

3915

HALL'S EFFECT IN CHROMIUM–MOLYBDENUM ALLOYS. N. V. Grum-Grzhimailo and I. A. Popov. Zhur. Neorg. Khim. 3, 1227–31(1958) May. (In Russian)

The dependence of the Hall constant on the composition of chromium–molybdenum alloys was investigated, and the chemical interactions of Cr_5Mo, Cr_3Mo, Cr_3Mo_2, and Cr_2Mo were found. The presence of these intermolecular interactions leads to the anticipation of thermodynamic conditions in which the isolation of new phases is possible. (R.V.J.)

3916

THE CHEMICAL BEHAVIOR OF ZIRCONIUM. Warren B. Blumenthal. Princeton, N. J., D. Van Nostrand Company, Inc., 1958. 404p.

A survey of the chemical behavior of Zr and its compounds is presented. The first chapter discusses the history, occurrence, extraction, and properties of Zr. Chapters two through five present interstitial solutions and intermetallic compounds, zirconium halogenides, zirconium oxides and the zirconates, and zircon and the complex silicates. The next four chapters present some of the organic compounds of zirconium along with inorganic acids. (W.L.H.)

3917

TECHNOLOGY OF COLUMBIUM (NIOBIUM). Papers Presented at The Symposium on Columbium (Niobium) of The Electrothermics and Metallurgy Division of The Electrochemical Society May 15 and 16, 1958, Washington, D. C. B. W. Gonser and E. M. Sherwood, eds. New York, John Wiley & Sons, Inc., 1958. 127p.

Niobium is a high melting metal whose compounds are in general nonbasic in character. It forms refractory binary compounds with elements of Groups III, IV, V. Its melting point and reactivity impose restrictions on methods of preparation. The metal is of par-

ticular interest as a high temperature material of construction because of its strength at high temperatures and its workability. The sources, economic aspects, and supply situation are described. A review of the extractive metallurgy is presented. A solvent extraction system is presented for separating Ta and Nb. The preparation of high-purity Nb by electrolytic processes is described. Analytical methods are presented for determining impurities in Nb. Tensile properties and rolling textures are presented for Nb sheet. The electroplating of metals on Nb is discussed. The development of oxidation-resistant Nb alloy is discussed. (W.L.H.)

3918
MODERN MATERIALS. Advances in Development and Applications. Vol. 1. Henry H. Hausner, ed. New York, Academic Press Inc., 1958. 410p.

This volume covers a variety of materials and the recent developments in connection with these materials. Some of the materials covered are: zirconium, germanium and silicon semiconductors, insulating papers for high voltages, radiation resistant glasses, synthetic rubbers for special purposes, new uses of wood as a structural material, and organic and inorganic fiber materials. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

Refer also to abstracts 4326, 4327, 4328, 4329, 4330, 4337, 4338, 4355, 4356, 4357, 4358, 4359, 4360, 4367, and 4371.

3919 AERE-GP/R-2001
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CONSTRUCTION AND BEHAVIOUR OF A STRUCTURE SUITABLE FOR ACCELERATING PROTONS FROM 150 TO 600 MEV. D. J. Thompson. Oct. 1958. 21p. $0.56 (BIS).

A full-size section of a proton linear accelerator is described which is 10 feet long, resonant at 405 Mc, and suitable for acceleration at an energy of about 400 Mev. The structure consists of E_{010} pill-box resonators operated in π-mode and coupled by resonant loops. Details of design, method of construction, and detailed R.F. behavior are given, and the structure is shown to have satisfactory efficiency and tolerances. (auth)

3920 CERN-PS/AC-3
European Council for Nuclear Research, Geneva.
ON A POSSIBLE LAY-OUT FOR THE TARGET BUILDING. A. Citron. Mar. 13, 1954. 13p.

The geometry of the target building has to be determined by the experiments which are likely to be carried out in it. As it is very difficult to forcast these experiments, a maximum degree of flexibility is a first requirement. It seems reasonable to put the stress on the paths of the highest energy nucleons and mesons which can be extracted from the machine, as interest will be concentrated on them. The interactions of the particles in targets that the beam is allowed to strike at the end of the acceleration process are investigated. (W.D.M.)

3921 CERN-PS/CS-12
European Council for Nuclear Research, Geneva.
ON THE CHOICE OF THE HARMONIC VALUE M. Ch. Schmelzer. Aug. 8, 1953. 9p.

A method of determining the maximum harmonic value in the design of a proton synchrotron is presented. The value is determined by certain fundamental design factors of the machine and is independent of the top particle energy of the machine below 100 Bev. The calculations are approximations and are valid for machines with top particle energies of 10 to 100 Bev, with injection energies up to 400 Mev, and transit energies above 3 Bev. (J.R.D.)

3922 MURA-431
Midwestern Universities Research Assn., Madison, Wis.
THEORY OF THE AG SYNCHROTRON. George Parzen. Aug. 15, 1958. 27p. Contract AT(11-1)-384. $4.80 (ph OTS); $2.70(mf OTS).

The general results obtained for an accelerator having a general magnetic field are applied to the case of the AG synchrotron. Results are found for the properties of the equilibrium orbits, the tune, and the betatron oscillations as a function of the particle momentum. The theoretical results are expected to be good within an error of 10% for presently considered machines. The theoretical results are compared with those found on the IBM 704 computer. A summary of the results is given. It is also pointed out that it is possible to choose the parameters of the linear AG machine so that either ν_r or ν_z is independent of energy to first order in the energy change. (auth)

3923 ORNL-2644
Oak Ridge National Lab., Tenn.
CYCLOTRONS AND HIGH-ENERGY ACCELERATORS ---1958. F. T. Howard. Nov. 17, 1958. 315p. Contract W-7405-eng-26. $5.00(OTS).

In all, 140 cyclotrons and other high-energy accelerators are reported. Verified data are provided for 108 of these; amount of data available for the remainder varies. Questionnaires were sent to all laboratories for which addresses were available. Data supplied on the questionnaires were edited only enough to provide some uniformity in terminology. Where the questionnaires were not returned by publication time, data accumulated from journals, press releases, and personal communications are given. (W.D.M.)

3924 UCRL-8377
California. Univ., Berkeley. Radiation Lab.
THE STRAY RADIATION FIELD OF THE BEVATRON. Alan R. Smith. July 16, 1958. 76p. Contract W-7405-eng-48. $2.00(OTS).

Radiation survey work at the Berkeley Bevatron has been a continuous project of the Health Physics Group since start-up of the accelerator in November 1954. A substantial body of survey data has accumulated, from which a general pattern for the stray radiation field can be constructed. This report includes a summary of the characteristics of the radiation field pattern as currently understood, a description of the various techniques used to make radiation measurements, and a discussion of some serious problems encountered in survey work at the accelerator. (auth)

3925
THE CERN 600 Mev SYNCHRO-CYCLOTRON. Arne Lundby (CERN, Geneva). Discovery 19, 56-9(1958).

The design and operation of the CERN 600-Mev synchrocyclotron are discussed. Some of the problems currently being studied by means of the accelerator are mentioned. (A.C.)

3926
150 KV COCKCROFT-WALTON TYPE PARTICLE ACCELERATOR. C. S. Khurana and H. S. Hans

(Muslim Univ., Aligarh, India). Indian J. Phys. 32, 468-72(1958) Oct.

Details of the 150 kv Cockcroft-Walton type particle accelerator constructed in this laboratory are given. Use of radio-frequency ion-source, and 250 kv isolation transformer for supplying voltage to the various circuits in the ion-source head, are its main features. A steady current of protons of more than 100 μa at the target has been obtained. (auth)

3927

EUROPE'S INTERNATIONAL ACCELERATOR BEGINS WORK. A. W. Merrison. New Scientist 3, 28-9(1958) Feb. 27.

The history of accelerators is reviewed. The design, construction, and operation of the 600-Mev CERN synchrocyclotron are described. (A.C.)

3928

PHASOMETER METHOD FOR MEASURING ALTERNATING PHASE RATES IN A WAVE GUIDE. O. A. Val'dner and N. P. Sobenin (Moscow Inst. of Engineering Physics). Pribory i Tekh. Ekspt. No. 4, 19-21 (1958) July-Aug. (In Russian)

The equipment design and principle of phasometric phase rate measurement in a diaphragm waveguide of an electron linear accelerator is described. The problems of precision measurements and the obtained results are discussed. Applications of the method for diaphragm waveguides with constant phase rates are also discussed. (tr-auth)

3929

REVIEW OF NUCLEAR PARTICLE ACCELERATION. V. I. Veksler. Uspekhi Fiz. Nauk 66, 99-110(1958) Sept. (In Russian)

A review is presented of various types of particle accelerators, their performance, and future developments in cyclic methods. In addition to the methods dealing with one isolated particle in given magnetic and electric fields, new ideas are discussed in relation to the collective interactions of particles. The so-called relativistic stabilized beam, the coherent method of acceleration, and the idea of plasma waveguides are described. (R.J.)

3930

COHERENT RADIATION OF ELECTRONS IN THE SYNCHROTRON. I. L. V. Iogansen and M. S. Rebinovich (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 1013-16(1958) Oct. (In Russian)

The potential of the radiation field of a single relativistic electron, moving in a circle and simultaneously executing small phase oscillations, is investigated. A general expression for the spectrum of the radiation field potential of a bunch were obtained with the potential of a single phase-modulated electron and of the distribution function of the particles in the bunch. The expression is valid for sufficiently low harmonics for which the radiation is coherent. (tr-auth)

PHYSICS AND MATHEMATICS

General

Refer also to abstracts 4342, 4361, 4363, 4364, and 4372.

3931 AECU-3833

Ford Instrument Co., Long Island City, N. Y.

CRITICAL MASS AND NEUTRON FLUX DISTRIBUTION. Interim Report. June 22, 1956. 71p. Contract AT(30-3)-215. $12.30(ph OTS); $4.50(mf OTS).

Critical mass calculations for a reactor are given. The numerical calculations are shown for fission product poisoning, heavy element formation, temperature coefficient of reactivity and average neutron flux distribution. (T.R.H.)

3932 AECU-3907

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. SWITCHING THEORY. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Aug. 1958. 17p. Contracts AT(11-1)-415; N6ori-07130; and Nonr-1834(15). $3.30(ph OTS); $2.40(mf OTS).

Detailed circuit design of the shifting register test unit was completed. Two designs were evolved for a two-input memory element. Equations for hydrodynamic flow with shocks are derived. An investigation was made of the properties of circuits which are semimodular and yet contain arbitrary delays at the inputs to all logical elements. Operation and use of the ILLIAC are described. (For preceding period see AECU-3839.) (W.D.M.)

3933 AECU-3916

Washington Univ., St. Louis.

ELECTRICAL CONDUCTION IN A MERCURY-PUMPED VACUUM SYSTEM (thesis). Preston Vincent Murphy. June 1956. 76p. Contract [AT(11-1)-85]. (M-5958). $12.30(ph OTS); $4.50(mf OTS).

Electrical conduction in a high vacuum is investigated. The experimental equipment and procedures are described in detail. In addition, discussions of certain phenomena such as the spark and the dark current, including primary electron emission, secondary positive ion emission, and particle exchange, are discussed. (J.R.D.)

3934 AECU-3917

Washington Univ., St. Louis.

ELECTRIC CONDUCTION IN AN OIL-PUMPED VACUUM SYSTEM (thesis). Ernest A. Bryant. May 1956. 107p. Contract AT(11-1)-85. (M-5952). $16.80(ph OTS); $5.70(mf OTS).

The leakage of electricity across a vacuum space in an electrostatic generator which employs a mixture of Sr^{90} and Y^{90} as the source of charging current was investigated. The vacuum is obtained by means of an oil pump. The leakage was shown to consist of a flow of positive and negative particles between the anode and the cathode. The positive particles were found to be primarily organic ions produced in a layer of oil on the surface of the anode. The negative particles were shown to be mostly electrons. Yields of secondary negative particles and secondary positive particles produced by average positive particles in the energy range from 50 to 200 kev were measured. Yields were found to be dependent on the nature of the target material as well as on the energy of the incident ion. A mass spectrometer was employed to study the nature of the positive ions. Most of these were charged fragments of organic molecules. Neutral particles were attributed to dissociation of a portion of positive ions during their flight from the anode to cathode. Electrons, most of which originate at the beta source, are presumed to be the agent for positive ion production. It is believed that the leakage current at a limiting voltage is primarily

due to a positive ion-negative ion exchange mechanism. (A.C.)

3935 AECU-3918
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Sept. 1958. 16p. Contracts AT(11-1)-415 and Nonr-1834(15). $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see AECU-3907.) (W.D.M.)

3936 AERE-A/R-2711
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE OPTICAL DESIGN OF BEAM MATCHING SYSTEMS. T. R. Walsh. Oct. 1958. 19p. $0.42(BIS).
Beam matching is considered with reference to beams which may be represented by ellipses in phase space. A general expression for the profile of such beams is obtained and used to examine the parameters of a single-lens system. Extension of the treatment to more complex systems is discussed. (auth)

3937 AERE-R/M-198
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RESONANCE ABSORPTION IN A SLAB WITH A PARABOLIC TEMPERATURE DISTRIBUTION. A. Keane. Sept. 1958. 18p. (NPCC/RPWP/P-148).
The idealized problem of a plane beam of neutrons impinging on a slab of U^{238}, across which the temperature has a parabolic distribution with a maximum at the center of the slab, is investigated. The calculations are based upon a simplified model of the U^{238} resonance structure, and scattering in the material is neglected. It is concluded that, for a 1/E spectrum of incident neutrons, the resonance absorption will be the same as when the slab is at a uniform temperature which differs from the arithmetic mean of the parabolic distribution by less than 8% of the difference between the maximum and minimum temperatures. (auth)

3938 AERE-R/R-2695
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SLOWING DOWN OF FISSION NEUTRONS IN AN INFINITE HOMOGENEOUS MEDIUM. G. Rowlands. Oct. 1958. 19p.
The slowing down of fast neutrons produced uniformly in an infinite non-capturing homogeneous medium with a fission spectrum energy distribution was studied. A simple approximate expression for the flux as a function of energy was obtained and found to give values in error by at most 15%. A correction to this expression is given from which values correct to a few per cent may be obtained. Numerical results for energies above 0.1 Mev are presented for hydrogen, deuterium, and carbon. For energies in the range thermal to about 0.1 Mev, the flux for all non-capturing media shows the well-known 1/E dependence. (auth)

3939 AFOSR-TN-58-188
Purdue Univ., Lafayette, Ind.
STATISTICAL DERIVATION OF NUCLEAR ROTATIONAL ENERGIES. Kailash Kumar. [1958]. 20p. Contract AF18(600)-1579. (AD-152222).
The nucleus is treated as a Fermi gas under the constraints of constant angular momentum and quadrupole moment. The deformation dependence of the nuclear moments of inertia is then derived on the basis of a model in which only the nucleons outside a certain spherical core produce all the angular momentum. The influence of the surface effects and the velocity dependent forces is also taken into account. Over-all agreement with the experimental data is obtained. (auth)

3940 AFOSR-TN-58-781
Cornell Univ., Ithaca, N. Y.
ULTRA-SMALL-ANGLE X-RAY SCATTERING. Technical Report No. 2. L. G. Parratt, J. O. Porteus, H. W. Schnopper, and T. Watanabe. Dec. 20, 1958. 17p. Contract AF49(638)-402. (AD-202002).
Discussion is given of the extension of the conventional small-angle scattering techniques to angles in the range of a few seconds of arc. The magnitudes of the scattered intensity in this range are large. A new double two-crystal spectrometer is proposed for this work. It is believed that with this instrument, with a high-energy synchrotron as an x-ray source, with either perfect crystals on the spectrometer for the ultra-small angles or with deliberately imperfect crystals for the conventional angular range, and with the newly developed unfolding procedures to correct for the residual instrumental effects, the techniques of small-angle scattering would be advanced to new levels of usefulness in many problems of structural analysis. Interpretive theory, now undeveloped in the ultra-small-angular range and in some respects also in the conventional angular range, would probably not lag far behind. (auth)

3941 AFOSR-TN-58-784
Florida State Univ., Tallahassee.
AN EXPERIMENTAL STUDY OF X-RAY ATTENUATION COEFFICIENTS, 8-30 KEV. Final Report. Richard D. Deslattes. 1958. 80p. Contract AF18(603)-64. (AD-202009).
Precise values for the total attenuation coefficients have been obtained at approximately 1-kv intervals from 8 to 30 kv for 15 pure elements using a two-crystal spectrometer of high resolving power. These span the range of atomic numbers from 12 to 79. Possibly disturbing effects of small-angle scattering were investigated. The resulting values of μ for some elements may be assigned an average standard deviation of 0.2 percent. (auth)

3942 AFOSR-TR-58-1095
Ohio State Univ. Research Foundation, Columbus.
RARE EARTH OXIDES. III. THE HEAT CAPACITIES OF YTTRIUM OXIDE (Y_2O_3), LANTHANUM OXIDE (La_2O_3) AND NEODYMIUM OXIDE (Nd_2O_3) FROM 16 TO 300°K. Technical Report No. 3. H. W. Goldstein, E. F. Neilson, P. N. Walsh, and David White. Oct. 1958. 21p. Project No. 77520. Contract AF18(600)-1545. (AD-207596).
The heat capacities of the sesquioxides of yttrium, lanthanum, and neodymium were determined in the temperature range 16 to 300°K. The entropies, enthalpies, and free energy functions were calculated from the heat capacity data and are tabulated for several temperatures. Yttrium oxide and lanthanum oxide exhibit typical sigmoidal heat capacity curves with no anomalies in the temperature range studied. The shape of the heat capacity curve for neodymium oxide is similar except that at the lowest temperature there is evidence for the existence of an anomaly. At 298.16°K the entropies are 23.693 ± 0.07 and 30.580 ± 0.07 cal

mole^{-1}deg^{-1} for yttrium oxide and lanthanum oxide, respectively. For neodymium oxide $S_{298.16}-S_{16}$ is 33.607 cal mole^{-1}deg^{-1}. The free-energy functions have been extended to 2500°K by the use of some higher temperature heat capacity data available in the literature. (auth)

3943 APEX-406

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

EXTENSION OF PROGRAM C_2 TO INCLUDE MIXED NUCLEAR FUELS. B. H. Duane and D. S. Selengut. Sept. 7, 1957. 13p. (XDC-57-10-136). $3.30(ph OTS); $2.40(mf OTS).

Computer programs for solving the reactor criticality equations have usually assumed a single fissionable material, or at least similar spectra for all fuels present. This report discusses the extension of such programs to the general case of mixed fuels. It is shown that the problem can be solved by carrying out a separate calculation for each spectrum individually, solving a set of algebraic equations, and using the results to combine the separate flux distributions by superposition. The detailed procedure for application to ANP program C_2 is given for the case of two fuel materials. (auth)

3944 APEX-439

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

TEST DATA FROM THE 2π SOLID-ANGLE SHIELD-COVER EXPERIMENT. R. H. Clark, J. G. Carver, R. F. Brenton, W. L. Weiss, and R. F. Rohrer. Dec. 19, 1958. 246p. Contracts AF-33(600)-38062 and AT(11-1)-171. $3.50(OTS).

The experimental data are the results of tests conducted at the Oak Ridge Tower Shielding Facility in which 2π solid-angle covers were used on both the reactor shield and crew shield. These tests were conducted to provide basic air- and ground-scattering data, as well as to determine the minimum requirements for facilities needed to develop a nuclear aircraft shield. The data are presented as recorded. Some of the more important data have been selected and grouped to show the effects of the 2π covers. (auth)

3945 APEX-443

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

REACTOR KINETIC THEORY. Task 4314-2-1, Job 51328. P. G. Fischer. Aug. 18, 1958. 18p. Contract [AT(11-1)-171]. $3.30(ph OTS); $2.40(mf OTS). (XDC-58-10-105).

Normal mode reactor kinetic behavior in which the system is described by the Boltzmann transport equation with time independent cross sections is shown to be rigorously equivalent to the familiar single parameter "off-critical" reactor theory. This procedure provides a rigorous definition of the kinetic coefficients appearing in the single parameter equations independent of any approximation involved in the solution of the Boltzmann equation. For situations of normal engineering interest in control and poison reactivity "worth" measurements the kinetic coefficients are only slightly dependent on any except gross reactor properties and a general period versus reactivity relation may be defined for a given reactor. The numerical evaluation by first order perturbation theory of the kinetic "constants" together with a tabulation of the resulting period versus reactivity relation for any range of reactor periods is provided as a subroutine of machine Program C_4 (a bare reactor calculation). The mechanized calculation should be sufficient for all situations of current engineering interest. (auth)

3946 BNL-489

Brookhaven National Lab., Upton, N. Y.

PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 309p. $5.00(OTS).

Twenty-eight of the thirty-five papers presented at the conference are included with discussions. Abstracts of the remaining seven papers are given. The seven sessions were devoted to: radiation effects on graphite, nuclear properties of graphite, graphite lattice reactivities, chemistry of graphite, chemical reactions between liquid Na and Zr, slug canning for the ORNL Graphite Reactor, and critical assemblies. Separate abstracts have been prepared for each of the twenty-eight papers. (T.R.H.)

3947 BNL-489(p.2-8)

France. Commissariat à l'Énergie Atomique, Paris.

INTERCOMPARISON OF GRAPHITE IRRADIATIONS. H. Hering, P. Pério, and M. Sequin. p.2-8 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 7p.

While fast neutrons only are effective in damaging graphite, results of irradiations are more or less universally expressed in terms of thermal neutron fluxes. Attempts are made to correlate irradiations made in different reactors, i.e., in fluxes of different spectral compositions. These attempts are based on comparison of bulk length change and volume expansion, and crystalline properties (e.g., lattice parameter, magnetic susceptibility, stored energy, etc.). The methods used by various authors for determining the lattice constants of irradiated graphite are discussed. (auth)

3948 BNL-489(p.10-17)

Oak Ridge National Lab., Tenn.

THE EFFECT OF FISSIONABLE PARTICLE SIZE ON FISSION DAMAGE IN GRAPHITE. R. H. Kernohan. p.10-17 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 8p.

In order to determine the relative amount of fission fragment damage in graphite as a function of fuel particle size, a number of molded graphite test specimens containing 5% by weight of enriched uranium oxide particles were irradiated for one month in the ORNL Graphite Reactor along with control specimens containing no uranium oxide. Specimens in the form of rectangular bars three inches long were measured both before and after irradiation in order to find possible changes in weight, modulus of elasticity, electrical resistivity, and thermal conductivity. Results showed that decreases in weight and thermal conductivity and increases in electrical resistivity and the modulus of elasticity of the same order of magnitude occurred in all specimens but were particularly severe for specimens in which the UO_2 particle size was less than 44 microns. Annealing studies up to 750°C indicated that annealing of fission damage did not occur. The amount of fission damage was compared with results of theoretical calculations and found to be in fair agreement. (auth)

3949 BNL-489(p.19-20)
Argonne National Lab., Lemont, Ill.
THE SLOW NEUTRON ABSORPTION CROSS SECTION OF GRAPHITE. G. R. Hennig. p.19-20 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 2p.

The neutron cross section of C^{13} was determined by measuring the amount of C^{14} formed during monitored exposure of enriched C^{13}. It is so small (0.9 mb per mole of C^{13}) that it contributes only insignificantly to the total absorption cross section of graphite. The slow neutron cross section of C^{12} has been obtained by determining the increase in C^{13} concentration in graphite samples exposed for very long times in neutron reactors. The value obtained from three exposures is 3.3 ± 0.15 mb for C^{12}. However, the exposures were not monitored directly but estimated from the power dissipation of the reactor. It is believed that because of uncertainties in the exposure, the cross section may possibly constitute a lower limit rather than an absolute value. It can, however, be considered as an absolute value if combined with the measurements of Muehlhause which establish 3.3 mb as the upper limit to the total cross section of graphite. (auth)

3950 BNL-489(p.21-2)
Republic Aviation Corp., Farmingdale, N. Y.
THE SLOW NEUTRON ABSORPTION CROSS SECTION OF GRAPHITE. C. O. Muehlhause. p.21-2 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 2p.

A specially purified specimen of graphite was prepared by the Great Lakes Carbon Corporation for the purpose of learning whether a reactor grade graphite could be made having a smaller thermal absorption cross section than 4.5 mb. Using the original enriched heavy water reactor at Argonne, measurements were made of the thermal neutron cross section of graphite by the technique of pile oscillation. Comparisons were made with both boron and a sample of standard reactor grade graphite. The purified specimen was found to have a significantly lower cross section than the standard sample. (auth)

3951 BNL-489(p.23-30)
France. Commissariat à l'Énergie Atomique, Paris.
THERMAL FLUX FLATTENING AND INCREASE OF REACTOR OUTPUT. J. Horowitz and J. Bussac. p.23-30 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 8p.

It is worthwhile, when building power reactors, to have excess reactivity in order to increase rating by fitting closely together the heat sources and the cooling possibilities. The power per unit volume of a graphite reactor can then be increased, given the power of the most heavily loaded channel. The solutions adopted for G.1, G.2, and E.D.F.1 are described here, and also the improvements based on the actual neutron flux flattening, the introduction of several zones for the coolant, the variation of uranium rod and coolant channel diameters according to their location, and finally the change in lattice pitch. The perturbation of neutron flux due to variation of mean absorption in the lattice is also discussed. (auth)

3952 BNL-489(p.32-41)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION DAMAGE TO GRAPHITE FROM 30° TO 185°C. R. E. Nightingale and J. F. Fletcher. p.32-41 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 10p. (HW-47776(Rev.)).

Property changes in polycrystalline graphite resulting from reactor irradiations at temperatures up to 185°C and over a range of exposures up to 1135 MD/CT have been determined. Changes in stored energy, thermal conductivity, sample length, and C_0 interlayer crystallite spacing are markedly decreased as exposure temperature is increased. Electrical resistivity changes are also less at higher exposure temperatures, but this property change does not depend as strongly on temperature as the others. Isothermal annealing studies of C_0 changes were conducted on a number of irradiated samples. The data were analyzed assuming a large number of processes distributed in activation energy. The results are summarized in activation energy spectra in which the distribution of C_0 damage is given as a function of the activation energy required for annealing. It is found that not only does a higher exposure temperature decrease the total amount of property change, but also the distribution of damage accumulated is considerably different. Results are discussed in terms of the radiation damage model suggested by Hennig and Hove. This model is compatible with the experimental results presented. (auth)

3953 BNL-489(p.42-5)
France. Commissariat à l'Énergie Atomique, Paris.
SOME PHYSICAL METHODS FOR STUDY OF IRRADIATION EFFECTS IN GRAPHITE. G. Mayer, M. Lecomte, and R. Mattmuller. p.42-5 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 4p.

A calibration method for a classical apparatus for differential thermal analysis is described in detail. This method achieves a relative precision of 5% in the measurement of the internal energy release accompanying the annealing of irradiated graphites. Elastic constants of graphites are obtained from the frequencies of the longitudinal modes of vibration; procedures for excitation and detection of these vibrations at any temperature between −190° and +1500°C are described. A procedure for obtaining easily measured deformations of graphites after relatively little irradiation with thermal neutrons is discussed. An application of this method to the study of the thermal annealing of elongation caused by displaced atoms is indicated. (auth)

3954 BNL-489(p.46-51)
Brookhaven National Lab., Upton, N. Y.
EFFECT OF PILE RADIATION ON MECHANICAL AND OTHER PROPERTIES OF GRAPHITE. R. A. Meyer and R. G. Bourdeau. p.46-51 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6p.

The effect of fast neutrons has been determined on growth rate, C_0-axis, compressive strength, and stored energy in graphite exposed in the Brookhaven Reactor. The growth rate is proportional to the flux and temperature history of the sample. The contraction on annealing is proportional to the growth since the last anneal. The

rate of increase in C_0-axis is approximately ten times the rate of gross growth. However, the percentage of recovery is the same for C_0 as for the gross growth after a thermal or pile anneal. The changes in dimensions and C_0-axis as well as the compressive strength and stored energy of graphite will be discussed as a function of reactor operational procedures. (auth)

3955 BNL-489(p.52-67)
Brookhaven National Lab., Upton, N. Y.
CONTROL OF RADIATION DAMAGE IN A GRAPHITE REACTOR STRUCTURE BY ANNEALING. R. W. Powell. p.52-67 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 16p.

In annealing operations being conducted at Brookhaven National Laboratory a new and interesting effect is being observed. This is that the growth is approaching an equilibrium maximum value, which probably depends on the annealing procedures. It may be concluded that sufficient information is now available on the rates of graphite growth under varying conditions and on methods of controlling growth, that graphite structures might be designed with considerably more assurance than in the past. (auth)

3956 BNL-489(p.69-84)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DETERMINATION OF k_∞ FROM CRITICAL EXPERIMENTS WITH THE PCTR. D. J. Donahue, D. D. Lanning, R. A. Bennett, and R. E. Heineman. p.69-84 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 16p.

This paper was previously abstracted as NSA 13-129.

3957 BNL-489(p.85-8)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE NUCLEAR PARAMETERS OF SOME GRAPHITE, NATURAL URANIUM LATTICES MEASURED IN THE PCTR. D. D. Lanning, D. J. Donahue, and R. A. Bennett. p.85-8 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 4p.

Techniques described earlier have been used to investigate a series of graphite—natural uranium lattices with the Physical Constants Testing Reactor (PCTR). Infinite medium, thermal neutron multiplication factors k_∞ and thermal utilizations f have been determined. Analysis of these data yields a value of η for natural uranium of 1.313 ± 0.013. The error is a 67% confidence limit obtained from measurements on fuel rods of three sizes at several lattice spacings. (auth)

3958 BNL-489(p.89-94)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE NUCLEAR PARAMETERS OF SOME LARGE PROCESS TUBE LATTICES DETERMINED FROM PCTR MEASUREMENTS. D. D. Lanning, D. J. Donahue, and R. A. Bennett. p.89-94 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6

Measurements of k_∞ have been made for three fuel configurations in a $2\frac{1}{8}$-in.-o.d. process tube as a function of the graphite to uranium atomic ratio. These measurements were made in the PCTR. The three fuel elements and types of coolants are: 1.68-in.-outside diam. solid natural uranium rods with air cooling; 1.68-in.-outside diam. and 0.75-in.-inside diam. natural uranium cored slugs, externally cooled only, with air, light water, and organic (MIPB) cooling; 7-rod cluster of $\frac{1}{2}$-in. natural uranium rods evenly distributed in the 2-in.-inside diam. tube with air and water cooling. All the uranium was canned in aluminum jackets, and the outer process tube was aluminum with a wall thickness of 0.064 in. The assembly was placed in a $2\frac{1}{8}$-in. hole in the graphite. The atomic ratios are given for the materials used in the various lattices relative to the uranium in the lattice. (auth)

3959 BNL-489(p.97-126)
France. Commissariat à l'Énergie Atomique, Paris.
FRENCH RESULTS ON THE NATURAL URANIUM—GRAPHITE LATTICES. J. C. Koechlin, P. Tanguy, and C. P. Zaleski. p.97-126 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 30p.

Some of the most important results are given from the experiments carried out in 1956 on the G.1 reactor, the first French graphite pile. The material is divided into the following sections: nuclear description of the G.1 reactor; diffusion length and channel anisotropy in G.1 graphite; slowing down of neutrons in graphite from 1.45 ev to thermal energy; measurement of the thermal utilization factor in the G.1 reactor; measurement of the p factor in the G.1 reactor; buckling and critical size measurements at different loads of G.1; heating up experiment; measurement of the temperature coefficient; and neutron temperature measurement in G.1 by modulation of the neutron beam. An appendix on experimental equipment for flux measurements is included. (auth)

3960 BNL-489(p.127-37)
Brookhaven National Lab., Upton, N. Y.
GRAPHITE TEMPERATURE COEFFICIENT OF THE BROOKHAVEN NATIONAL LABORATORY REACTOR. Joseph M. Hendrie. p.127-37 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 11p.

The vacuum graphite temperature coefficient of reactivity of the BNL reactor was measured as a part of a graphite anneal run. Its value was -0.63 ± 0.06 ih/°C over a range of mean graphite temperature of 20 to 160°C, and increased to $+0.33 \pm 0.06$ ih/°C at 220°C. The fuel exposure corresponded to 338 megawatt-days per ton, average. These values are to be compared to the clean reactor value of -158 ih/°C at 20°C. (auth)

3961 BNL-489(p.141-4)
Argonne National Lab., Lemont, Ill.
EFFECTS OF RADIATION AND CATALYSIS ON OXIDATION OF GRAPHITE. G. R. Hennig. p.141-4 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 4p.

Natural graphite flakes of high purity, irradiated in vacuo, were used. Preliminary experiments showed that the condition of the surface and the presence of certain catalytic impurities affect the burning rate

enormously. If these confining effects are avoided, it is found that heavy neutron irradiation seems to have little effect upon the reactivity of graphite to oxygen. The rates were measured between 300 and 600°C. Activation energies and frequency factors are presented. (auth)

3962 BNL-489(p.145-55)
Brookhaven National Lab., Upton, N. Y.
THE EFFECT OF RADIATION ON THE RATE OF OXIDATION OF GRAPHITE. W. L. Kosiba, G. J. Dienes, and D. H. Gurinsky. p.145-55 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 11p.

The purpose of this investigation was to determine the influence of radiation-induced lattice defects and the effect of various types of radiation on a gas-solid reaction. The results are of practical interest for graphite moderated reactors. The graphite–oxygen reaction was studied in a gamma radiation field, in the radiation field of the Brookhaven Reactor, and in the absence of any radiation. The graphite-air reaction was carried out inside the reactor and also in the absence of any radiation. The temperature range was 250 to 450°C. Graphite samples were irradiated in the Brookhaven Reactor and the oxidation studied subsequently by measuring the weight loss as a function of time in a stream of oxygen or air. An exposure of 4×10^{20} neutrons/cm^2, which produces about 2% displaced atoms at room temperature, increases the rate of oxidation by about a factor of 5 to 6 relative to the unirradiated sample. The oxidation rate of untreated samples in the presence of gamma-rays alone (200,000 r/hr) is slightly increased. A more significant increase is observed at the higher intensity of 600,000 r/hr. The reaction rate of samples previously irradiated (4×10^{20} neutrons/cm^2) in the reactor and oxidized in the presence of gamma-rays (200,000 r/hr) at 300°C is higher by an additional factor of about 4, i.e., a factor of about 20 relative to unirradiated specimens. It is concluded that displaced atoms exert a large influence on the rate of this heterogeneous gas-solid reaction. When, in addition, ionizing radiation is present during the reaction, the rate is further increased, probably because of the ionization of oxygen molecules. The oxidation of virgin graphite inside the Brookhaven Reactor was performed at two different fluxes (2×10^{12} and 6×10^{12} neutrons/cm^2-sec) at 250, 300, 350, and 400°C. It was found that the rate depends on the temperature, flux, and type of oxidant. At 250 and 300°C the rates at the higher flux are 20 to 30 times higher than those of virgin graphite oxidized in the absence of radiation. A combination of effects arising from the presence of displaced atoms and ionization of the oxygen molecules is probably responsible for the increased rate. However, at 350 and 400°C not only are the rates lower than those at 300°C in the higher flux, but they are lower by a factor of about 6 than for virgin graphite oxidized in the absence of any radiation field. The rates in the lower flux increase with increasing temperature, but the rate at 400°C is lower by a factor of 10 than the thermal oxidation rate for virgin graphite. This inhibition of the oxidation reaction in the reactor at the two higher temperatures is a well reproducible result. The explanation for this inhibition is not known at the present time. Whenever air is used as an oxidant the rates are lower than with pure oxygen by a factor of 2 to 4. (auth)

3963 BNL-489(p.156-8)
Argonne National Lab., Lemont, Ill.
CHEMICAL REACTIONS OF GRAPHITE. M. Dzurus, G. R. Hennig, and G. Montet. p.156-8 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 3p.

A brief survey is presented of typical chemical reactions of graphite. Reactions of graphite with hydrogen, reactions of graphite with sodium, and changes in general reactivity of graphite caused by irradiation are discussed in more detail. Graphite does not appear to form any stable lamellar compounds with hydrogen at least below 1000°C as indicated by electrical measurements. If graphite is bombarded with accelerated protons, these are retained by the lattice, apparently as either hydrogen molecules or ions but not as hydrogen atoms. The hydrogen diffuses at elevated temperatures with an activation energy of about 12 kcal. Very pure sodium does not appear to react with polycrystalline graphite at temperatures up to 450°C. (At higher temperatures carbide is formed.) Small amounts of impurity will, however, cause reaction. In Pyrex apparatus, enough potassium is apparently leached out of the glass to cause some reaction. Sodium hydroxide, sodium oxide, barium oxide, and other impurities cause rapid visible interactions of sodium with graphite. The reactions decrease the electrical resistivity. We believe this change to indicate that the oxide occupies what we have called "spacer" positions in the lattice and thus facilitates the intercalation of sodium. Irradiation of graphite decreases the rate at which it reacts with certain substances like bromine or sulfuric acid. The reasons for this are discussed. It will be shown that a similar effect may well increase the reactivity to sodium although this speculation has not yet been tested. (auth)

3964 BNL-489(p.159-67)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
INTERACTIONS OF GRAPHITE WITH LIQUID SODIUM. Stephen C. Carniglia. p.159-67 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 9p.

Observations and measurements of the chemical interactions of graphite and sodium are reviewed, covering the temperature range 100 to 900°C. Interpretations of the observed effects are given in terms of the unique structure and properties of graphite. Phenomena discussed include wetting and capillarity, graphite expansion, corrosion and material transfer, and formation of sodium-graphite interstitial compounds. (auth)

3965 BNL-489(p.168-73)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RECENT INFORMATION ON MODERATOR SHEATH CORROSION IN LIQUID SODIUM. Robert L. Eichelberger. p.168-73 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6p.

Results are reported of recent experimental work concerned with the interaction of liquid sodium and dissolved impurities with zirconium and its alloys, niobium, molybdenum, and stainless steel. For zirconium, grain growth and mechanical property changes are

discussed. Corrosion behavior as a function of temperature and impurity level in the sodium is described. (auth)

3966 BNL-489(p.174-86)
Oak Ridge National Lab., Tenn.
ALPHA CANNING OF URANIUM SLUGS FOR THE ORNL GRAPHITE REACTOR. J. E. Cunningham and R. E. Adams. p.174-86 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 13p.

The significant factors affecting the performance of the aluminum-clad uranium fuel elements used in the ORNL Graphite Reactor are reviewed. The important requirements of a diffusion barrier, a metallurgical bond, and a leak-proof closure were achieved for the present reactor loading by using canning techniques in which the heat-treated uranium slugs were dipped into a molten aluminum-silicon alloy bath. A diffusion-resistant layer of $U(Al,Si)_3$ compound forms at the uranium surface. The coated slug, the cap, and the can are assembled while submerged in a second aluminum-silicon alloy bath, and are brazed together with a thin layer of aluminum-silicon eutectic alloy to form a thermal-conducting bond and a tight closure. The techniques used in the canning operation are described and discussed. The performance of the fuel elements, from the aspect of resistance to failure in reactor service, is briefly reviewed. Information is presented on the radiation-induced growth which occurs. A significant cause of rupture is traced to longitudinal growth of certain lots of slugs which were not correctly beta heat-treated prior to canning; slugs correctly heat-treated show very little growth. (auth)

3967 BNL-489(p.189-210)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BUCKLING MEASUREMENTS WITH ENRICHED URANIUM IN GRAPHITE SYSTEMS. E. D. Clayton. p.189-210 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 22p.

The results are given from a series of buckling measurements with enriched uranium in graphite lattices. The uranium enrichments used were 0.94%, 1.007%, 1.44%, and highly-enriched (uranium greater than 90% by weight U^{235}). The bucklings were determined as a function of the lattice spacing; the effect of a water coolant channel on the buckling was also investigated. The experiments include the results for several hollow fuel elements. Data are also given on natural uranium bucklings which can be used for comparison with the enriched uranium cases. (auth)

3968 BNL-489(p.211-15)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE CALCULATION OF THE THERMAL NEUTRON FLUX DISTRIBUTION IN A UNIT LATTICE CELL—COMPARISON OF EXPERIMENT AND THEORY. C. R. Richey. p.211-15 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 5p.

The P_3 approximation to the Boltzmann transport equation for cylindrical geometry has been used to compute the thermal neutron distribution in a unit lattice cell. The P_3 solution has been programmed for the IBM-702 electronic data-processing machine. A discussion of this solution and program is given. Thermal neutron distributions obtained from the method are given and compared with experimental flux traverses in a graphite lattice cell with both air and light water coolants. (auth)

3969 BNL-489(p.217-23)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PHYSICS EXPERIMENTS PERFORMED FOR AND ON SODIUM GRAPHITE REACTORS. W. W. Brown, R. W. Campbell, C. A. Guderjahn, and R. A. Laubenstein. p.217-23 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 7p.

The physics experiments performed on sodium graphite lattices include both exponential experiments and measurements made on the Sodium Reactor Experiment. A series of exponential experiments was performed on lattices with 4, 6, and 7-rod fuel clusters in a graphite moderator which could be arranged to provide one of three different lattice spacings. Lattice buckling and intracell flux distribution measurements were made. Experimental measurements in the Sodium Reactor Experiment have not been completed to date. The measurements which have been made include determinations of the critical mass both with and without sodium in the reactor core and determination of neutron flux distributions, safety rod effectiveness, temperature coefficient, and the reactivity value of additional fuel elements beyond the critical loading. (auth)

3970 BNL-489(p.224-31)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TWO-GROUP NEUTRON PHYSICS CALCULATIONS FOR THE SODIUM REACTOR EXPERIMENTS. F. L. Fillmore. p.224-31 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 8p.

An analysis of exponential experiments for graphite-uranium lattices is presented. The resonance escape probability is treated empirically, and a value is obtained for the effective resonance integral to be used in making two-group criticality calculations for SRE. The results of the criticality calculations are given for three reactor cases. The theoretical reactivity worth of additional fuel and the reactivity worth of control rods are presented. The steady-state temperature coefficient is discussed. (auth)

3971 BNL-489(p.232-7)
France. Commissariat à l'Énergie Atomique, Paris.
REACTIVITY MEASUREMENTS IN G.1. J. Bernot. p.232-7 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6p.

Reactivity measurements made on the G-1 Reactor are described and interpreted. Kinetic, static, and compensation methods were used in measuring reactivity changes for various reactor modifications. (T.R.H.)

3972 BNL-489(p.239-74)
Nuclear Development Corp. of America, White Plains, N. Y.
A GRAPHITE MODERATED CRITICAL ASSEMBLY—

CA-4. E. L. Zimmerman. p.239-74 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 36p.

Material in this paper was presented in Y-881, dated Dec. 7, 1952. Decl. Sept. 17, 1957. Work performed at the Oak Ridge National Lab., Y-12 Area, 1951.

A graphite moderated enriched uranium critical assembly was constructed to provide an experimental check for certain reactor calculation methods and to evaluate a number of experimental procedures used in the Oak Ridge National Laboratory critical facility. In order to minimize uncertainties in subsequent measurements and calculations, the assembly was kept as simple as possible. The assembly approximated a uniformly loaded, unpoisoned, bare cube, containing relatively well-known reactor materials. This simple critical assembly proved to be an excellent tool for basic reactor physics studies. The size of the assembly was 51.0 × 51.0 × 44.11 in., and the critical loading was 52.48 kg U^{235}. With the critical assembly as a model and assuming an extrapolation distance of 2 cm, a bare reactor, 32 group calculations gave a value 0.9912 for the effective multiplications. Several measurements were made by one or more experimental techniques and compared to calculated results where possible. The observed quantities included: control and safety rod evaluations by rod drop and pile period methods; the effect of neutron streaming in a void; importance functions for fuel and moderator; reactivity coefficients for various materials; fission power distribution by the catcher technique; flux distribution; cadmium fractions; and the effect of transverse gaps on reactivity. In general, the agreement with calculated results was satisfactory. In the case of the reactivity effect of small gaps, the disagreements with earlier theoretical treatment of the problem prompted an effort to improve the existing calculation method for evaluating this effect. Danger coefficients for sodium, iron, nickel, and molybdenum were calculated from the multigroup neutron spectrum and the known cross section data. These values are in substantial agreement with the corresponding observed values. The effect of a sodium filled channel in the reactor was investigated. A 3 × 2-in. hole extending from the center of the assembly to the outside along a major axis was filled stepwise with sodium. Plugging the hole near the outside edge of the assembly with sodium caused a slight increase in multiplication, while completely filling the hole gave a small net loss. (auth)

3973 BNL-489(p.275-90)
California. Univ., Livermore. Radiation Lab.
STUDIES OF ENRICHED URANIUM GRAPHITE REACTOR SYSTEMS. Albert J. Kirschbaum. Appendix: SELF SHIELDING. W. S. Gilbert. p.275-90 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 16p. (UCRL-4983-T).

A/CONF.15/P/2408 supersedes this information in this paper.

The results to date are presented from studies of essentially homogeneous enriched uranium (93.5% U^{235}) graphite systems. Critical configurations for bare and graphite or beryllium reflected cores are given for carbon to uranium atomic ratios of 600:1, 1200:1, and 2400:1. The results of experiments to determine the systematic errors are given. This allows reduction of the critical size data to idealized geometries for comparison with neutronic calculations. By use of a pulsed neutron source, data on the prompt neutron population relaxation time as a function of buckling were obtained. The experimental technique and resultant data are discussed. A comparison of the critical buckling and time behavior data with a simple modified Fermi age theory is made. This includes discussion of the prompt neutron lifetime effectiveness of the control and safety rod system, the bulk neutronic properties of the graphite, and self shielding effects of the uranium. (auth)

3974 BNL-489(p.291-6)
Los Alamos Scientific Lab., N. Mex.
GRAPHITE MODERATED, GRAPHITE REFLECTED CRITICAL ASSEMBLIES. Cleo C. Byers. p.291-6 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6p.

Essentially the same as AECU-3605, which was previously abstracted as NSA 12-4429.

3975 BNL-489(p.297-302)
Los Alamos Scientific Lab., N. Mex.
CRITICAL ASSEMBLIES OF GRAPHITE AND ENRICHED URANIUM WITH BERYLLIUM REFLECTORS. G. E. Hansen, J. C. Hoogterp, J. D. Orndoff, and H. C. Paxton. p.297-302 [of] PROCEEDINGS OF THE FRENCH-AMERICAN CONFERENCE ON GRAPHITE REACTORS, [HELD AT BROOKHAVEN NATIONAL LABORATORY], NOVEMBER 12 TO 15, 1957. 6p. (AECU-3604).

This paper was previously abstracted as report number AECU-3604, NSA 12-4428.

3976 CERN-PS/WG-3
[European Council for Nuclear Research, Geneva.]
FURTHER CONSIDERATIONS ABOUT THE RADIATION SHIELDING FOR 30 GeV PROTONS. A. Citron and W. Gentner. June 9, 1953. 18p.

Details which may affect the absorption of radiation, and especially the interaction of 30-Bev protons with matter, are examined. From these considerations, conclusions are drawn upon which the accelerator design is based. Included are specifications for the trench which contains the accelerator tube, the target area, and the roof. (J.R.D.)

3977 CU-168
Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. [George B.] Pegram Lab.
LOW ENERGY NEUTRON SCATTERING BY NON SPHERICAL NUCLEI. Eugene Serge Troubetzkoy. May 29, 1958. 52p. Contract AT-30-1-GEN-72.

The scattering and absorption of low-energy neutrons by deformed nuclei is investigated using the cloudy crystal ball model of Feshbach, Porter, and Weisskopf which shows that the strength function $\bar{\Gamma}_n^0/D$, i.e., the average neutron width to the average level spacing, can be related to the amplitude of scattering by a complex potential. Their derivation relies on the Breit-Wigner many level formula, which was derived assuming spherical symmetry of the nuclear field. The Wigner-Eisenbud treatment is generalized to a non-spherical nucleus by treating the problem in spheroidal rather than spherical coordinates. A dispersion theory treatment was applied in order to obtain a general expression for the strength function. The strength function is

related to the levels of zero binding energy in the complex square well. (auth)

3978 IDO-12004
Weather Bureau, Idaho Falls, Idaho.
THE ENGINEERING CLIMATOLOGY OF THE NATIONAL REACTOR TESTING STATION. G. A. De Marrais. Nov. 1958. 84p. $13.80(ph OTS); $4.80 (mf OTS).

Data are presented, in a form useful to designers and engineers, on the temperature, moisture content of the air, precipitation, winds, state of the ground, dust, and human comfort at the National Reactor Testing Station. The reasons for any significant variations in the observed parameters are discussed. (auth)

3979 KLX-10113
Vitro Labs., West Orange, N. J.
ROTATIONAL "TEMPERATURE" MEASUREMENTS OF THE HIGH INTENSITY ARC TAIL FLAME. Technical Note No. 4. A. W. Diniak, C. Roth, S. Korman, and C. Sheer. Aug. 7, 1958. 21p. Contract AF18(603)-3. (AFOSR-TN-58-735; AD-201351).

Rotational temperatures in the tail flame of the high intensity arc at atmospheric and at reduced pressures are determined by measuring the radiation intensity distribution of the rotational fine structure of the C_2 (0,0) Swan band at λ 5165, and of the OH (0,0) ultraviolet band at λ 3064. A comparison is made between temperatures obtained from the C_2 species, and those obtained from the OH species by both the fundamental and the iso-intensity methods. A discussion of the rotational temperature results obtained is included. (auth)

3980 KLX-10116
Vitro Labs., West Orange, N. J.
VAPOR PHASE CARBOTHERMIC REDUCTIONS OF MAGNESIUM OXIDE IN THE HIGH INTENSITY ARC. Technical Note No. 6. S. Korman, A. Diniak, and C. Sheer. Aug. 22, 1958. 20p. Contract AF18(603)-3. (AFOSR-TN-58-498; AD-158308).

A laboratory investigation of the vapor-phase reduction of magnesium oxide was carried out in the tail flame of a d-c high intensity arc. Thermodynamic considerations were used to predict an approximate temperature-dependence for the homogeneous reaction, $MgO + C \rightarrow Mg + CO$, indicating this reaction goes to completion above 1800°C. Since the lowest recorded temperature in the flame was ~2000°C, it was assumed that the flame consisted predominantly of reaction products. This was verified by spectrographic observation. The positioning of a water-cooled, copper quench plate for product sampling was fixed by considerations of heat flux and flame temperature as determined spectrographically. For ⅝-inch diameter anodes, containing slightly greater than a stoichiometric fraction of carbon, a 7 kw arc operating in 0.1 atm. of nitrogen yielded a product representing 64% reduction of the oxide with an equivalent power consumption of 8.2 kwh/lb of metal. It was concluded that the reaction was a homogeneous one and that the high intensity arc technique offers interesting possibilities in the carbothermic reduction of stable metal oxides. (auth)

3981 LA-2237
Los Alamos Scientific Lab., N. Mex.
GAMMA-RAY ABSORPTION COEFFICIENTS FOR ELEMENTS 1 THROUGH 100 DERIVED FROM THE THEORETICAL VALUES OF THE NATIONAL BUREAU OF STANDARDS. Ellery Storm, Eugene Gilbert, and Harvey Israel. Apr. 1957. 306p. Contract W-7405-eng-36. $5.00(OTS).

A compilation of gamma-ray absorption coefficients for elements 1 through 100 derived from the theoretical values of the National Bureau of Standards is presented. (A.C.)

3982 NP-7027
Polish Academy of Sciences. Inst. of Nuclear Research. Nuclear Resonance Lab., Krakow.
METHOD OF MEASUREMENT OF LONG SPIN-LATTICE RELAXATION TIMES IN LIQUIDS. J. W. Hennel and A. Z. Hrynkiewicz. [1955]. 6p.

The measurement of spin-lattice relaxation time of a liquid sample consists of two separate parts: the measurement of the completely desaturated nuclear magnetization $\underline{M}$ and the measurement of the momentary values of the vector $\underline{M}$ during the time of its growth from zero after a complete saturation. The nuclear magnetic resonance device is arranged in such a way that it is possible to change alternatively the frequency of the current in the modulating coils. The output of the nuclear resonance detecting apparatus is recorded on photographic paper tape by means of a mirror oscillograph. (A.C.)

3983 NP-7051
Lockheed Aircraft Corp., Marietta, Ga.
CONVERSION OF RADIATION DATA TO COMMON DENOMINATORS. W. T. Harper. Oct. 1958. 29p. Contract AF33(600)-32055. (NR-45).

A detailed procedure with sample calculations is given for converting radiation data to units useful for comparing data obtained at different facilities. Gamma radiation data are converted to units of carbon gamma dose (erg/g), and neutron data are converted to water neutron dose (erg/g). (auth)

3984 NP-7055
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
EXTENDED INVARIANCE PROPERTIES OF QUANTUM FIELDS. I. LAGRANGIAN FORMALISM. M. E. Mayer. 1958. 19p.

The consequences of invariance of Quantum Field Theory under an f-parameter Lie group are investigated. The consequences of invariance of a general Lagrangian under such a group are also considered. It is shown that the invariance leads to the conservations of f, current density operators, the corresponding charge operators being a representation of the Lie group on the state vector space. Invariance under extended transformations, i.e., transformations in which the parameters are functions of the space-time point leads to the necessity of introducing f noncommuting vectors fields. The general structure of the Lagrangian corresponding to these fields is established and their possible physical counterparts are discussed. (auth)

3985 NP-7070
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for The Period July–October 1958. Oct. 1, 1958. 42p.

A theoretical criterion for the classification of all spin-½ particles into leptons and baryons is presented. It is shown by direct calculation that the self-energy of the longitudinal neutrino vanishes in the lowest-order perturbation calculation, in which the interactions involving neutrinos are taken to be those containing four fermions represented by the Puppi triangle. A prelimi-

nary study of the photodisintegration of C^{12} into three alpha particles was made by means of the stars produced in nuclear emulsions. Emulsions exposed to a 21.5-Mev bremsstrahlung beam showed 113 $C^{12}(\gamma,3\alpha)$ reactions. The rate equations which describe energy production in thermonuclear reactions are presented for a deuterium–tritium plasma. In order to extend techniques for measuring temperature, ion densities, etc., a series of diagnostic experiments involving high-speed photography and spectroscopy are described. The design and construction of an external injector for the NRL electron synchrotron are described, including the focusing and deflecting wires and the injector mounting. The experimental results obtained to date are presented. Two solutions are given to the equations governing the adiabatic collapse in radius of a relativistic electron beam injected into hydrogen. A preliminary investigation of the transverse instability of an electron beam injected into hydrogen is described. Preliminary results are given for an investigation on the effects of bubbles on the pitting corrosion of mild steel in stream generators. The program on dosimetry by luminescence degradation in dielectrics is reviewed. (For preceding period see NP-6926.) (W.D.M.)

3986 NYO-8702

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

ULTRAHIGH VACUUM TECHNIQUES. Quarterly Progress Report [for] August 1–October 31, 1958. Research Report No. 403-FF-312-R3. Nov. 24, 1958. 13p. Contract AT(30-1)-2176. $3.30(ph OTS); $2.40 (mf OTS).

The investigation of three plastic, Teflon, Kel-F, and Marlex, as soft-seat materials for valves has continued. Investigations were conducted on metal valves and liquid metal valves for high-vacuum systems. The mass spectrometer was used to identify gases contributing to pressure rise in a closed system. Apparatus was designed and constructed for studying adsorption of active gases on evaporated metal films. (W.L.H.)

3987 ORNL-2629

Oak Ridge National Lab., Tenn.

SOME PROBLEMS IN STATISTICAL INFERENCE. J. J. Gant. Dec. 31, 1958. 121p. Contract W-7405-eng-26. $2.75(OTS).

The following topics are discussed in this paper: extension of the Cramer-Rao inequality, asymptotic properties of ML estimates when sampling, and a sequential decision procedure for comparing survival. (W.L.H.)

3988 ORO-SP-68(Vol.III)

Johns Hopkins Univ., Bethesda, Md. Operations Research Office.

PROCEEDINGS OF THE ARMY-ORO CONFERENCE ON BASIC AND APPLIED RESEARCH AND COMPONENT DEVELOPMENT, JUNE 23–JULY 2, 1958. VOLUME III. PAPERS 17, 22, 28, AND 29. Jerome B. Green, ed. Aug. 1958. 66p.

Geophysics and the underground atomic tests, communications, and electronics are discussed in connection with a program to outline the long-range research programs of the U. S. Army. (T.R.H.)

3989 ORO-SP-68(Vol.IV)

Johns Hopkins Univ., Bethesda, Md. Operations Research Office.

PROCEEDINGS OF THE ARMY-ORO CONFERENCE ON BASIC AND APPLIED RESEARCH AND COMPONENT DEVELOPMENT, JUNE 23–JULY 2, 1958. VOLUME IV. PAPERS 10, 11, 13, AND 15. Jerome B. Green, ed. Aug. 1958. 90p.

The basic principles of thermonuclear reactions are presented. High-sensitivity microwave devices in communications are discussed. The U. S. Army research program is outlined. Future trends in research in electronics components and devices are discussed. (T.R.H.)

3990 ORO-SP-68(Vol. V)

Johns Hopkins Univ., Bethesda, Md. Operations Research Office.

PROCEEDINGS OF THE ARMY-ORO CONFERENCE ON BASIC AND APPLIED RESEARCH AND COMPONENT DEVELOPMENT, JUNE 23–JULY 2, 1958. VOLUME V. PAPERS 20, 24, AND 35. Jerome B. Green, ed. Aug. 1958. 47p.

Lectures on "Propellants and Energy Storage," and "Electronic Packaging" are presented. (T.R.H.)

3991 ORO-SP-68(Vol. VI)

Johns Hopkins Univ., Bethesda, Md. Operations Research Office.

PROCEEDINGS OF THE ARMY-ORO CONFERENCE ON BASIC AND APPLIED RESEARCH AND COMPONENT DEVELOPMENT, JUNE 23–JULY 2, 1958. VOLUME VI. PAPERS 12, 18, AND 32. Jerome B. Green, ed. Aug. 1958. 48p.

The development of computers in size and capacity is predicted for the next 10 years. Current research in cryogenics is discussed. (T.R.H.)

3992 PA-TR-2377

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

PYROELECTRIC EFFECTS IN LUCKY CIRCUITS. L. William Doremus. Jan. 1957. 20p. DA Project 505-01-003Z.

The pyroelectric effect in barium titanate compositions was examined. The voltage generated by the pyroelectric effect in ceramic barium titanate connected to a resistive load and subjected to temperature changes in the range −65 to 165°F was calculated. Under open circuit conditions, voltages sufficient to function existing military ordnance carbon and wire bridge detonators may be generated; however, under closed circuit conditions, such voltages are not generated. A discussion of pyroelectricity is included, along with graphs and equations for various circuit conditions. (J.R.D.)

3993 PB-131755

Naval Research Lab., Washington, D. C.

THE LITERATURE OF SPACE SCIENCE AND EXPLORATION. Bibliography No. 13. Mildred Benton, comp. Sept. 1958. 278p. $4.00(OTS).

A fairly exhaustive bibliography of references to published information including books, periodical articles, and research reports on the more scientific aspects of space exploration, both theoretical and applied, is presented. Some news reports are included. The references are divided into two categories: pre-satellite and satellite literature. Included are all references to the Russian Sputniks and the U. S. Army's Explorers, which it has been possible to locate through a search of indexes and journals. (J.E.D.)

3994 SCTM-188-58(51)

Sandia Corp., Albuquerque, N. Mex.

ELECTRICAL OPERATIONS MANUAL FOR THE SANDIA CORPORATION TWELVE-INCH WIND TUN-

NEL. Mahlon George Baker. Apr. 23, 1958. 35p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

A description of the operational and maintenance procedures for the electrical controls, electronic components, and instrumentation of the Sandia Corporation 12-in. wind tunnel facility is presented. (auth)

3995 UCRL-5271

California. Univ., Livermore. Radiation Lab. BENT QUARTZ CRYSTAL SPECTROGRAPH DATA. E. L. Chupp, J. W. M. DuMond, F. J. Gordon, R. C. Jopson, and Hans Mark. June 30, 1958. 125p. Contract W-7405-eng-48. $19.80(ph OTS); $6.30(mf OTS).

Tables comprising the original data from the spectrographic emulsions exposed during the A-48 research program are given. The wavelengths of many of the calibration lines used in this work (particularly the rare earth K x rays) are in the process of being measured at other laboratories. This tabulation is provided so that redeterminations of the unknown x-ray and gamma-ray wavelengths may be carried out by reference to the basic emulsion measurements. (auth)

3996 UCRL-5407

California. Univ., Livermore. Radiation Lab. TRAPPING AND LIFETIME OF CHARGED PARTICLES IN THE GEOMAGNETIC FIELD. N. C. Christofilos. Nov. 28, 1958. 12p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

Trapping of charged particles, especially fast electrons, within the geomagnetic field was examined. Since the lines of the geomagnetic field converge towards the earth, they act as magnetic mirrors in which fast electrons can oscillate back and forth. If the reflection points are in the upper atmosphere the electrons are scattered by the air molecules. Since the atmospheric density decreases exponentially outwards, this scattering occurs more or less near the mirror points. Due to this scattering process the mirror points move downwards. In a steady state, where particles are injected at constant rate, the density of the electrons below the altitude of injection varies inversely proportional to the air density. Lifetimes of several days to several years are possible depending on the location of the mirror points. Relativistic electrons might be artificially injected by a satellite carrying a low-current electron accelerator. Such a controlled experiment can be used to probe the extent of the region of closed magnetic lines of the earth's field near the poles and thus probe the extent of the closed line region on the equatorial plane. Also, the atmospheric density can be measured as well as the density of the solar corona or other interplanetary gas enveloping the earth. (auth)

3997 USNRDL-TR-269

Naval Radiological Defense Lab., San Francisco. CROSS SECTIONS FOR THE $Mg^{24}(n,p)Na^{24}$, $Al^{27}(n,\alpha)Na^{24}$, $Si^{28}(n,p)Al^{28}$, $Cr^{52}(n,p)V^{52}$, AND $Fe^{56}(n,p)Mn^{56}$ REACTIONS. J. M. Ferguson, W. E. Thompson, and B. D. Kern. Oct. 10, 1958. 32p.

The cross sections for the $Mg^{24}(n,p)Na^{24}$, $Al^{27}(n,\alpha)Na^{24}$, $Si^{28}(n,p)Al^{28}$, $Cr^{52}(n,p)V^{52}$, and $Fe^{56}(n,p)Mn^{56}$ reactions have been measured for neutrons produced by the $H^3(d,n)He^4$ reaction. The activation method was used, with the gamma rays which are emitted following beta decay being counted with a NaI(Tl) scintillation crystal. The $Mg^{24}(n,p)Na^{24}$ cross section is found to be 219 ± 26 mb at 13.0 Mev. The $Al^{27}(n,\alpha)Na^{24}$ cross section varies smoothly from 139 mb at 13.0 Mev to 106 mb at 15.7 Mev. The $Si^{28}(n,p)Al^{28}$ cross section changes smoothly from 370 mb at 12.3 Mev to 160 mb at 18.3 Mev, with a broad peak at 13.5 Mev with the maximum value of 380 mb. The $Cr^{52}(n,p)V^{52}$ cross section decreases slowly from 125 mb at 12.3 Mev to 72 mb at 18.3 Mev. The $Fe^{56}(n,p)Mn^{56}$ cross section is found to be 131 ± 15 mb at 15.3 Mev. The results are generally in agreement in those cases where previous results of others exist. (auth)

3998 USNRDL-TR-288

Naval Radiological Defense Lab., San Francisco. DETERMINATION OF GAMMA-RAY ABUNDANCE DIRECTLY FROM THE TOTAL ABSORPTION PEAK. D. F. Covell. Dec. 4, 1958. 30p.

A method is described for quantitatively determining gamma-ray activity using data obtained from scintillation spectrometer pulse-height distributions. Direct analysis is made of the digital data contained in that part of the distribution known as the total absorption peak, and a statistical evaluation of the precision of the method is presented. Methods used for quantitative interpretation of gamma-ray pulse analysis data, where discrete gamma rays are being observed, have usually involved some form of graphical reduction. The subjectivity inherent in the preparation and interpretation of the graphic form, however, sacrifices precision. Greater precision is realized by taking advantage of the digital nature of pulse height distribution data and applying statistical methods of reduction. Application of the method to radiochemical analysis is described. (auth)

3999 WADC-TN-58-91

Wright Air Development Center. Propulsion Lab., Wright-Patterson AFB, Ohio and Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
COP II, A MULTIGROUP-MULTIREGION REACTOR PROGRAM. John W. Benoit and Clinton R. Foulk. Oct. 21, 1957. 138p. Project No. 3162-30508.

A program is given which is designed to make static diffusion theory computations of thermal and intermediate spherical reactors. The program is coded for the ERA 1103 with line printer. The Selengut-Goertzel slowing down model has been used for hydrogen. Inelastic scattering has not been included. The program will accommodate two to thirty regions inclusive with U^{235} fuel in any or all regions. A maximum of 21 elements per region is allowed with the restriction of 57 elements per reactor. The maximum number of space points depends upon the number of regions in the following manner: $N_{max} = 175 - 3j_f$ where j_f is the total number of regions. The separation of the space points may be varied from region to region. (auth)

4000 AEC-tr-3462

EMISSION OF Λ^0-PARTICLES DURING CAPTURE OF K-MESONS BY NUCLEI IN PHOTOEMULSION. N. P. Bogachev, S. A. Bunyatov (Buniatov), A. Vrublevskii, D. K. Kopylova, Yu. (Iu.) B. Korolevich, N. I. Petukhova, V. M. Sidorov, E. Skzhipchak, and A. Filipkovskii. Translated by Lydia Venters (Argonne National Lab.) from a publication of the Joint Institute of Nuclear Research, Moscow, 1957. 8p.

Decay events of Λ^0 particles produced by K^- mesons in emulsion were studied. An attempt was made to establish the correlation between the parental event and decay of the Λ^0 particle. The results of the investigation are tabulated. (A.C.)

4001 AEC-tr-3480
β 0-0 TRANSFORMATION WITH A CHANGE IN PARITY. B. V. Geshkenbein. Translated for Oak Ridge National Lab. from Zhur. Eksptl. i Teoret. Fiz. 34, 1349-50 (1958). 3p.

Attention is directed to the fact that the spectral form 0-0 (yes) of β transformation is in good agreement with the A-variation (the V-variation does not participate because of the selection laws), and formulas are introduced for the polarization of decay electrons and an angular electron-neutrino correlation. (A.C.)

4002 AEC-tr-3487
EQUATIONS WITH VARIATIONAL DERIVATIVES IN PROBLEMS OF STATISTICAL PHYSICS AND OF QUANTUM FIELD THEORY. (Uravneniya s Variatsionnymi Proizvodnymi v Problemakh Statisticheskoĭ Fiziki i Kvantovoĭ Teorii Polya.) N. N. Bogolyubov. Translated by David Franklin from Vestnik Moskov. Univ. 10, 115-24(1955). 12p. $0.50(OTS)

The method of equations in variational derivatives is examined. A new operator interpretation of the Schwinger theory of Green's function is presented on the basis of this method, and a single-particle approximation is formulated. The method is effective in problems related to the theory of statistical equilibrium of classical systems. In addition, a special form of the representation of the basic equations is established in which a form is assumed corresponding to the independent movement of particles in an external field. The actual interaction of the particles, also in the method of secondary quantization, is considered to be an operator structure of the external field. (J.R.D.)

4003 AEC-tr-3508
NEW METHOD OF EXCITING SPECTRA IN AN ATOMIC BEAM. V. A. Gromov. Translated for Los Alamos Scientific Lab. from Optika i Spektroskopiya 2, 669-71 (1957). 4p.

An apparatus is described which excites emission spectra in atomic beams by simultaneous imposition of an electron beam and an ultra-high frequency electric field. (T.R.H.)

4004 AEC-tr-3529
TEMPERATURE DEPENDENCE OF THE INTERNAL FRICTION OF PURE METALS AND ALLOYS. (Temperaturnaya Zavisimost' Vnutrenniago Treniya Chistykh Metallov i Splavov.) V. S. Postnikov. Translated by Lydia Venters (Argonne National Lab.) from Uspekhi Fiz. Nauk 66, 43-77(1958). 48p.

The capacity of a body to convert the energy of mechanical oscillations to heat is examined. These internal frictional forces amount to about 70% of the total resistance forces acting under real conditions on an oscillating body. Methods of friction determination are discussed, and it is pointed out that existing theories satisfactorily characterize the temperature dependence of the internal friction of well-annealed metals and alloys which do not go through a phase transition upon heating. However, the whole theory of internal friction is far from complete, because of its complexity and because of the limited number of systematic investigations which have been conducted. Formulas and graphs are included. 253 references. (J.R.D.)

4005 CEA-tr-R325
LA DÉDUCTION DE L'ÉQUATION DE FOKKER-PLANCK POUR LE PLASMA. (The Deduction of the Fokker-Planck Equation for Plasma.) S. V. Temko. Translated from Zhur. Eksptl.' i Teoret. Fiz. 31, 1021-6(1956). 15p.

The Bogolioubov method was used to deduce the Fokker-Planck equation for a plasma composed of several types of particles and with a homogeneous spatial distribution. The asymptotic case for behavior of plasma particles for high and low kinetic energies was also studied. (T.R.H.)

4006 CEA-tr-R381
RENDEMENT DE LUMINESCENCE DES SCINTILLATEURS EN MATIÈRE PLASTIQUE À LA TRIPHÉNYLPYRAZOLINE EN FONCTION DE LA TEMPÉRATURE. (Luminescence Yield of Scintillators in Plastic Material with Triphenylpyrazoline as a Function of Temperature.) I. M. Rozman. Translated by [B.] Vinogradoff from Optika i Spektroskopiya 2, 480-7 (1957). 17p.

The results of studies on the luminescence yield of scintillators in polystyrole base with 1,3,5-triphenylpyrazoline-Δ^2 as a function of temperature are reported. Some conclusions on the mechanism of the energy transfer, based on the experimental results, are presented. (tr-auth)

4007 CEA-tr-A449
ACTION D'INCLUSIONS NON MÉTALLIQUES SUR DES MATÉRIAUX À GRANDE PERMÉABILITÉ MAGNÉTIQUE. (Effect of Non-Metallic Inclusions on Materials with a Large Magnetic Permeability.) F. Lihl. Translated by R. Carbonnier from Acta Phys. Austriaca 11, 232-40(1957). 13p.

The effect of non-metallic inclusions on magnetic materials is shown on a steel sample having 4.3% silicon. The results, in complete accord with the Neel theory on the coercive force and on the shape of the magnetization curve, show that inclusions of this kind are particularly bad if their dimensions are in a critical interval which is between 0.05 and several microns for iron. However, some inclusions of larger size are disadvantageous on the measurement where they decrease the slope of the magnetization curve and as a result lower the permeability. The possibility of decomposing, by heating in a vacuum, the non-metallic inclusion pre-existing in steel and of preventing new inclusions is considered. (tr-auth)

4008 CEA-tr-R464
ETUDE DU MOUVEMENT TRANSVERSAL DES IONS PENDANT UNE DÉCHARGE DANS UN CHAMP MAGNÉTIQUE LONGITUDINAL INTENSE. (Study of the Transverse Motion of Ions During a Discharge in an Intense Longitudinal Magnetic Field.) A. Zharinov (Jarinov). Translated by M. Bouchicot from Zhur. Tekh. Fiz. 27, 1803-10(1957). 17p.

The variation of the direction of the transverse average velocity of ions was studied as a function of the gas pressure. The velocity direction was determined with a double rotating plate probe. The analysis of the results obtained led to the conclusion that with the aid of a rotating plate probe the general characteristics of the transverse movement can be determined. It was found that during a discharge in argon at a pressure $< 3 \times 10^{-3}$ mm, in spite of a high magnetic field ~2,300 gauss, a large quantity of the ions reach the side walls of the discharge chamber without collisions. The energy acquired by the ions in the radial electric discharge field was evaluated. (tr-auth)

4009 CEA-tr-R481
ETUDES QUANTITATIVES SUR L'ACTION PHOTO-

GRAPHIQUE DES ÉLECTRONS DE DIFFÉRENTES ÉNERGIES. I. SENSIBILITÉ AUX ÉLECTRONS DES ÉMULSIONS DE DEGRÉ DE MATURATION VARIABLE. (Quantitative Study on the Photographic Action of Electrons of Different Energies. I. Sensitivity to Electrons of Emulsions of Variable Degree of Aging.) K. S. Bogomolov, E. P. Dobroserdova, and V. N. Zharkov (Jarkov). Translated by B. Vinogradoff from Zhur. Nauch. i Priklad. Fot. i Kinematografii 1, 19-22(1956). 7p.

Experimental work is described on establishing the relation of photographic sensitivity of an emulsion to its degree of maturation. Monoenergetic electron beams of 20 to 90 kev were used in connection with an electronic sensitometry technique employing an electron microscope. The ratio of sensitivity for weakly ionizing radiation to sensitivity for strongly ionizing radiation (S_w/S_s) was found to increase with the degree of maturation of the emulsion. For very low values of degree of maturation, the ratio S_w/S_s tended asymptotically toward a constant value. The selectivity of an emulsion for weak or strong radiation can be controlled by varying the degree of maturation. (T.R.H.)

4010 NP-tr-161

ON THE QUESTION OF THE SYMMETRY OF THE MULTIELECTRON SCHROEDINGER WAVE FUNCTION. E. D. Trifonov. Translated for Lincoln Lab., MIT from Zhur. Eksptl'. i Teoret. Fiz. 34, 1643-4(1958). 4p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16509.

4011 NP-tr-175

A TESTING METHOD FOR RELATIVELY SHORT TURBINE BLADES AND THEIR PROFILING. R. N. Alekseeva, I. D. Dyakhovitskii, and U. V. Rzheznikov. Translated from Teploenergetika 6, 51-6(1956). 7p.

Various methods of static testing of relatively short active turbine blades are compared. Profiles are described which give high economy in the presence of a boundary layer at the exit. Profiling the height of the inter-blade channel, both for working blades and for guide blades, is recommended. Examples of such profiling are presented, along with profiles of test models. During evaluation of relatively short turbine blades it is essential, in the static testing, to simulate the nonuniformity of the flow into the cascade. It is concluded that the profiles which were developed satisfy the working conditions of a controlling stage. (J.R.D.)

4012 NP-tr-184

NUMERICAL CALCULATION OF MULTIDIMENSIONAL INTEGRALS. R. Von Mises. Translated for Lincoln Lab., MIT from Z. angew. Math. u. Mech. 34, 201-10 (1954). 20p.

In 1936, the author gave a theory of numerical cubature that has, since then, been differently treated in other papers. The theory is generalized to an arbitrary range of integration in the k-dimensional space, and some examples are given. (auth)

4013 NP-tr-194

ON THE MEASUREMENT OF THE TEMPERATURE OF THE CLOUD OF LUMINOUS VAPOURS IN PULSED ELECTRIC DISCHARGES. A. A. Labuda, E. G. Martinkov, and I. G. Nekrashevich. Translated by A. N. Dellis (U.K.A.E.A., Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, 720-4(1958). 11p.

Ornstein's method, which assumes the presence of thermodynamic equilibrium, is used in the temperature measurement of luminous gases and vapors. For a luminous cloud arising in a pulsed discharge, thermodynamic equilibrium is absent, therefore, the unrestricted use of the method is not justified in these cases. However, Ornstein's method may be used in a spark discharge and in the explosion of wires by taking into account the zonal distribution and time dependence of spectral lines excitation. It is not possible to calculate the values of temperature by this method from the relative intensity of two spectral lines with significantly higher energy values, since they are excited in different parts of the discharge where the values of temperature and moments of time are different. (auth)

4014 NP-tr-197

ON THE BROADENING AND SHIFT OF SPECTRAL LINES IN A HIGHLY IONIZED PLASMA. L. A. Vainshtein, V. G. Koloshnikov, M. A. Mazing, S. L. Mandel'shtam, and I. I. Sobel'man. Translated by A. N. Dellis (U.K.A.E.A., Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, 718-19(1958). 6p.

The character of the interaction of the radiating atoms with the charged particles and of lines with the quadratic Stark effect was investigated. A spark discharge was investigated where, owing to the high degree of ionization and temperature, it could be assumed that the broadening and shift of the lines were dependent on the interaction with the charged particles (the electrons and ions). (auth)

4015 SCL-T-214

THE ELECTRICAL PROPERTIES AND REAL STRUCTURE OF SINGLE-CRYSTAL FILMS OF GERMANIUM OBTAINED BY VACUUM EVAPORATION. (Electricheskie Svoistva i Real'naya Struktura Monokristal'nykh Plenok Germaniya, Poluchennykh Ispareniem v Vacuume.) G. A. Kurov, S. A. Semiletov, and Z. G. Pinsker. Translated by Marcel I. Weinreich (Sandia Corp.) from Kristallografiya 2, 59-63(1957). 13p.

Results are presented of an investigation of the electrical properties and structure of monocrystalline films of germanium obtained by means of evaporation in a vacuum on the surface of single crystals of germanium. The monocrystalline character of the films, established electronographically, is confirmed microscopically and by electron-microscopic investigations. However, the electrical properties of the films point to the presence of a large number of defects, which, apparently, cannot be revealed by the electronographic method. The defects in such films are analogous to the defects which arise during the deformation of a monocrystal. (auth)

4016

THE MAGNETIC STABILIZATION OF LOW PRESSURE D.C. ARCS. H. Wroe (Metropolitian-Vickers Electrical Co., Ltd., Manchester, Eng.). Brit. J. Appl. Phys. 9, 488-91(1958) Dec.

Self-sustaining d-c arc discharges between solid metal electrodes at pressures down to 10^{-4} mm of mercury were investigated. At pressures below a few millimeters of mercury, arcs on both refractory and non-refractory metals behaved like "cold cathode" arcs. "Spot-splitting" and "reverse driving" of the cathode spot were observed and a form of instability is described. Reverse driving of the cathode spot or spots by the magnetic field set up by the current in the electrodes themselves is suggested as the cause of the instability. A magnetic method of stabilizing the discharge is described, requiring an axial magnetic

field of at least 500 gauss. A marked constriction of the positive column was caused with this value of field. The magnetically stabilized discharge was used experimentally to produce short welds on $\frac{1}{8}$ in. thick mild steel plate at 1 μ of mercury pressure using about 40 a at 30 v. (auth)

4017

THE GRID EMITTING PROPERTIES OF TITANIUM. J. A. Champion (General Electric Co., Ltd., Wembley, Eng.). Brit. J. Appl. Phys. 9, 491-5(1958) Dec.

Experiments are described in which the emission from thin films of barium and barium oxide deposited on titanium is compared with that from similar deposits on tungsten. With deposits of both barium and barium oxide the emission from titanium is very much less than that from tungsten throughout the temperature range investigated (700 to 1000°C). Above about 900°C the evaporation of titanium will poison the emission of an adjacent oxide cathode, but it is concluded that from 700°C up to this temperature titanium would possess good grid emission suppression properties. This could enable titanium to be used as a screen grid winding wire in the place of carbonized molybdenum wire in a number of receiving valves, and as an electrode material in other electronic devices where hot electrodes become contaminated with cathode material. (auth)

4018

FUNDAMENTAL EQUATIONS OF MAGNETO-HYDRODYNAMICS AND SOME OF THEIR APPLICATIONS. John Carstoiu. Compt. rend. 247, 1716-18(1958) Nov. 17. (In French)

The general expression for the current density in a homogeneous and isotropic medium is considered. Possible applications of the equations obtained are discussed. (J.S.R.)

4019

THERMODYNAMICS OF SUPERCONDUCTORS. D. N. Zubarev and Yu. A. Tserkovnikov (Steklov Inst. of Mathematics, Academy of Sciences, USSR). Doklady Akad. Nauk SSR 122, 999-1002(1958) Oct. 21. (In Russian)

Thermodynamics of superconductors were previously studies on the basis of a model Hamiltonian in which electron-phonon interactions were replaced by direct interactions between electrons with contrasting pulses and spins. Studies are made of the superconductor thermodynamic properties by means of a Freilich Hamiltonian with a clear account of electron-phonon interactions. The thermodynamic theory of perturbation is used in the study. Following the N. N. Bogolyubov method, the phonon-electron interaction constant is renormalized, leading to a better convergence of dissociations and affording advantages similar to those in the case of zero temperatures. (R.V.J.)

4020

ON THE ABSORPTION COEFFICIENT OF Co^{60} γ RAYS IN SEMICONDUCTORS. B. I. Boltaks, B. T. Plachenov, and E. V. Semenov (Inst. of Semiconductors, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 72-5(1958) Nov. 1. (In Russian)

Measurements of absorption coefficients for Co^{60} γ rays (E_{γ_1} = 1.17 Mev, E_{γ_2} = 1.33 Mev) in some materials of various purity and modifications (selenium) are presented. Results of absorption coefficients for some metals (Al, Zn, and Pb) are also included. (R.V.J.)

4021

PHONON HEAT CONDUCTIVITY IN SUPERCONDUCTORS. B. T. Geilikman and V. Z. Kresin (Lenin, Moscow State Pedagogical Inst.). Doklady Akad. Nauk S.S.S.R. 123, 259-61(1958) Nov. 11. (In Russian)

The mechanism of lattice heat conductivity by the action of electrons on phonons was studied in the temperature range in which such interactions are predominant $T \geq (0.3 \text{ to } 0.5)T_k$. (R.V.J.)

4022

ELECTRON-OPTIC PROPERTIES OF A QUADRUPLE ELECTROSTATIC LENS (IN RELATIVISTIC APPROXIMATION). A. M. Strashkevich (Kiev Polytechnic Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 9, 929-32(1958). (In Russian)

Equations of the trajectory of a relativistic charged particle, integrated by the method of successive approximations, were obtained for fields with two planes of symmetry and two planes of antisymmetry. Formulas were derived for focal distances and coordinates of the principal points. Values necessary for the calculation of the coefficients are given for a number of lenses. A method is given for finding these coefficients experimentally for any quadruple system. A comparison is made with the results obtained by other authors for special cases and in non-relativistic approximations. (tr-auth)

4023

SPIN-MATRIX RELAXATION AND NUCLEAR MAGNETIC RESONANCE IN RARE-EARTHS SALTS. K. A. Valiev (Kazan State Univ.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 193-202(1958). (In Russian)

Experimental studies were made of the nuclear magnetic resonance in nuclei of rare earth paramagnetic ions. The width of the absorption line in magnetically weak salt crystals of rare earth ions was determined by the spin-lattice interactions of ions. The calculated probabilities of relaxation transitions for nuclear spins are compared with the relaxation transition probabilities of electron spins. It is shown that for the ions of rare earth salts the effect can be observed only at low temperatures. (tr-auth)

4024

ON THE DISPERSION RELATION FOR ELECTRON PLASMA. A. Voloshinskii and L. Kobelev (Gor'kii Urals State Univ.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. 6, 356-8(1958). (In Russian)

4025

ON THE SPIN DENSITY FLUCTUATIONS IN ELECTRON PLASMA. V. M. Eleonskii and P. S. Zyryanov (Kirov Ural Polytechnic Inst.). Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 6, 573-5(1958). (In Russian)

The dispersion equations obtained for spin density fluctuations show they do not affect the physical properties of metals; first, because the fluctuations are not produced by a thermal motion and second, because their contribution to fluctuation fields is much smaller than that of ordinary elastic (sound) fluctuations. (R.V.J.)

4026

ANGULAR DISTRIBUTION OF RESONANCE RADIATION EMITTED FROM A PLANE-PARALLEL LAYER. A. M. Samsonov (Inst. of Physics and Math., Academy of Sciences, Belorussian SSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 1, 65-73(1958) Jan. (In Russian)

Approximation expressions were developed for evalu-

ating the radiation intensity emitted from a plane-parallel layer. The expressions can be used for determining spectroscopic characteristics of radiation. (tr-auth)

4027

EFFECTS OF EXTERNAL DAMPING ON THE RECOMBINED INTERACTION OF THE BLUE AND GREEN LUMINESCENCE CENTERS IN ZnS-Cu PHOSPHORS. L. A. Vinokurov and M. V. Fok (Lebedev Inst. of Fiz., Physics, Academy of Sciences, USSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 2, 58-63(1958) Feb. (In Russian)

It is shown that with simultaneous external damping and recombination interactions of centers, the luminosity of the activator bands depends on the intensity of the excitation. The dependence is of such a nature that it may be accounted for by two co-multipliers, one of which is determined by the external damping and the other by the recombination interactions. The obtained formulas are used for determining the effects of temperature and activator concentration on each luminosity band. (R.V.J.)

4028

ELECTRON BOMBARDMENT HEATING FOR CRITICAL BOILING STUDIES. I. G. Kulakov and P. I. Povarnin (Inst. of Power Engineering, Moscow). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 3, 52-5(1958) Mar. (In Russian)

Applications of electron bombardment heating in studying critical boiling and the installation for experiments with critical boiling on large-volume cylindrical surfaces are described. Future uses of the method in heat exchange studies are discussed. (tr-auth)

4029

INVESTIGATIONS OF OPTICAL-GEOMETRIC RADIATION PARAMETERS. D. T. Kokarev (Construction Inst. of Chemical Equipment). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 7, 26-35(1958) July. (In Russian)

The relationship between ordinary and generalized angular radiation coefficients is established. A general analytical expression is obtained for the mean generalized angular radiation coefficient ψ_{ik}. Experimental methods of determining r_{ik}, K_m, and hence A_m and ψ_{ik} in the general case of the three-dimensional problem and medium are developed. (tr-auth)

4030

COMPARATIVE STUDIES OF SOME INFRARED RADIATION SOURCES IN 20 TO 110 μ RANGE. A. E. Stanevich and N. G. Yaroslavskii. Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 7, 49-53(1958) July. (In Russian)

The results of comparative investigations of the emission of a number of oxides of rare earths (Y_2O_3, ThO_2, CeO_2, and ZrO_2), a carborundum rod (SiC), platinum, nichrome, alundum (Al_2O_3) and a mercury discharge lamp PRK-4 show that yttrium oxide has the most intense radiation in the region of the spectrum from 20 to 110 μ at 1530°K. (tr-auth)

4031

THE USE OF PROTON RESONANCE FOR THE MEASUREMENT OF NON-HOMOGENEOUS MAGNETIC FIELDS. A. I. Zhernovoi, Yu. S. Egorov, and G. D. Latyshev (Inst. of Transportation, Leningrad). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 9, 123-7(1958) Sept. (In Russian)

Nuclear resonance equipment is described which makes it possible to use the phenomenon of nutation of the resultant magnetic moment of protons of water for the measurement of non-homogeneous magnetic fields. The choice of optimal parameters is considered and accuracy of measurement is estimated. (tr-auth)

4032

MEASUREMENT OF CARBON-METAL CONTACT RESISTANCES. H. L. Foltz and M. R. Hertz (Goodyear Atomic Corp., Portsmouth, Ohio). J. Electrochem. Soc. 106, 67-9(1959) Jan.

Results indicate that the largest unit pressure possible, applied uniformly over the contact surface, results in the lowest contact resistance. The use of copper alloys and magnesium results in lower contact resistance than does the use of steel. Copper contact plates were used and the tests confirm the suitability. Steel appears to be of doubtful value in this application. (auth)

4033

PRELIMINARY CLASSIFICATION OF THE SINGLY IONIZED PLUTONIUM ATOM (Pu II). J. R. McNally, Jr. and P. M. Griffin (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Am. 49, 162-6(1959) Feb.

A preliminary energy level scheme for Pu II was established based on 125 Zeeman patterns obtained with an Echelle-Littrow spectrograph and a magnetic field of approximately 24,000 gauss. The low electronic configuration involves the $^{6,8}F$ terms from $5f^{6}7s$. Seven low even levels and 84 high odd levels are given. (auth)

4034

PRELIMINARY CLASSIFICATION OF THE SPECTRUM OF SINGLY IONIZED ERBIUM (Er II). J. R. McNally, Jr. and K. L. Vander Sluis (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Am. 49, 200(1959) Feb.

4035

USE OF IRON-52 AS A RADIOACTIVE TRACER. P. E. Francois and Leon Szur (Hammersmith Hospital, London). Nature 182, 1665-7(1958) Dec. 13.

The physical characteristics of Fe^{52} were investigated to emphasize characteristics which may be useful in new applications. Method of preparation is discussed, as well as decay time and decay products. One application of Fe^{52} appears to be in studies of plasma iron turnover and early surface counting, to be repeated at short intervals. Other physiological applications are discussed including use with Fe^{59} in double labeling experiments. (J.R.D.)

4036

PLASMA MOTIONS INDUCED BY SATELLITES IN THE IONOSPHERE. Lester Kraus and Kenneth M. Watson (Convair, San Diego, Calif.) Phys. Fluids 1, 480-8 (1958) Nov.-Dec.

The electrohydrodynamic phenomena associated with the high-velocity motion of a charged body in a plasma are investigated with a view to applications to satellite motion in the ionosphere. It is shown that the effect of the electric field due to the charge on the body in inducing collective motion leads to similar results both for high- and low-density gases. By using a linearized theory, formulas are obtained for the electrohydrodynamic drag and for the increased ionization in the Mach cone behind the body. (auth)

4037

ENERGY PARTITION IN THE EXPLODING WIRE PHENOMENA. F. D. Bennett (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Phys. Fluids 1, 515-22(1958) Nov.-Dec.

Streak camera and oscillographic circuit-damping

data are presented for exploded copper wires varying in diameter from 3 to 8 mils. A maximum of specific shock-wave energy in the induced flow is found at a wire diameter different from that of a minimum in the total damping time of the circuit. This displacement is shown to be caused by the presence of residual circuit resistance. The proof is based on a critical analysis of optimum damping conditions in the exploding wire circuit. A maximum of apparent energy within the contact surface appears at about the same wire diameter as the minimum of total damping time. Discussion of the implications of the Taylor-Lin similarity theory indicates that lack of similarity of the flow is probably connected with the displacement of the maximum energies associated with shock-wave and contact surface. (auth)

4038

MEASUREMENT OF THE REFLECTED SHOCK HUGONIOT AND ISENTROPE FOR EXPLOSIVE REACTION PRODUCTS. W. E. Deal (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 523-7(1958) Nov.-Dec.

Measurement of the hydrodynamic state in an inert material adjacent to an interface with a detonating explosive yields a data point on the reflected shock Hugoniot of the explosive reaction products centered at the Chapman-Jouguet state or on the isentrope below this state. Such measurements have been made using various inert materials, for a range of shock impedances which yields pressures in the explosive reaction products from 515,000 bars down to 571 bars. The data fit a polytropic equation of state (P/ρ^{γ} = const. for the isentrope) with $\gamma = 2.77$. (auth)

4039

A DETONATION-PRODUCT EQUATION OF STATE OBTAINED FROM HYDRODYNAMIC DATA. W. Fickett and W. W. Wood (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 528-34(1958) Nov.-Dec.

A recent experimental measurement of the Chapman-Jouguet isentrope of the solid explosive Composition B., together with the experimental detonation velocity vs. initial density curve, gives considerable information about the equation of state of the detonation products. With the aid of some thermodynamic assumptions, a simple explicit form is obtained for the energy as a function of pressure and volume. (auth)

4040

EXPLOSIVELY INDUCED NONUNIFORM OBLIQUE SHOCKS. John O. Erkman (Stanford Research Inst., Menlo Park, Calif.). Phys. Fluids 1, 535-40(1958) Nov.-Dec.

At the high pressures induced by explosive attack, metals are assumed to behave like nonviscous, non-heat-conducting fluids. Within these assumptions, intensity and duration of explosively induced nonuniform oblique shocks are calculated by the method of characteristics for aluminum and copper in those cases involving supersonic flow both in the metal and in the explosive gas. Flow in both metal and explosive product gas is assumed to be isentropic even in the presence of shock waves. When a three-parameter equation of state is used for the gas, an arbitrary assumption must be made concerning the magnitude of one of these parameters, since pressure, density, and sound speed are known only for the Chapman-Jouguet point for the explosive gas. Reasonableness of this assumption is tested by comparing the results of the calculation with experiment. Results for oblique shocks confirm the results obtained previously for plane shocks in regard to the equation of state of the gas. (auth)

4041

LAMINAR BOUNDARY LAYER DEVELOPMENT BEHIND SHOCK WAVES IN ARGON. Russell E. Duff (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 546-7(1958) Nov.-Dec.

The equations describing the development of a laminar boundary layer behind a shock wave were solved on an analog computer for initial conditions corresponding to shock waves of several strengths in argon. The boundary layer temperature and velocity profiles for four shock compressions are tabulated. (A.C.)

4042

MULTIPACTING MODES OF HIGH-FREQUENCY GASEOUS BREAKDOWN. Albert J. Hatch (Argonne National Lab., Lemont, Ill.) and H. Bartel Williams (New Mexico Coll. of Agriculture and Mechanic Arts, State College). Phys. Rev. 112, 681-5(1958) Nov. 1.

A previously developed average electron theory for the $\frac{1}{2}$-cycle multipacting mode of low-pressure, high-frequency breakdown (secondary electron resonance) has been generalized and extended to higher order modes. A semitheoretical plot of breakdown voltage V vs the product of frequency times electrode separation $f \times d$ using representative fitting parameters is given for the $\frac{1}{2}$- through $\frac{9}{2}$-cycle modes. In addition to the customary $\frac{1}{2}$-cycle cutoff the theory predicts a modified cutoff in each of the mode transition regions. Breakdown data for internal metal electrodes at 2 microns pressure show the typical $\frac{1}{2}$-cycle cutoff at about 100 Mc-cm/sec plus a newly observed $\frac{3}{2}$-cycle cutoff as indicated by a dip in the breakdown curve at about 450 Mc-cm/sec. The $\frac{3}{2}$-cycle dip exhibits a strong dependence on electrode surface conditions. The theory is compared with multipacting breakdown data from several sources covering a wide range of conditions, including microwave breakdown at sufficiently low pressures. (auth)

4043

ANALYSIS OF GALVANOMAGNETIC DE HAAS-VAN ALPHEN TYPE OSCILLATIONS IN GRAPHITE. D. E. Soule (National Carbon Research Labs., Cleveland). Phys. Rev. 112, 708-14(1958) Nov. 1.

An analysis was made of oscillations in the Hall effect and magnetoresistance for graphite single crystals at 4.2°K with the field parallel to the hexagonal axis. Two periods of 2.11×10^{-5} gauss^{-1} and 1.58×10^{-5} gauss^{-1} are shown to be due to the majority electrons and holes, respectively. These same two values were found in both galvanomagnetic effects and are in reasonable agreement with those observed in the susceptibility. There is a phase difference of π between the two galvanomagnetic properties. An analysis of the magnetic field dependence of the amplitude incorporating both effects in a "galvanomagnetic ratio," ρ/R, has been made giving effective-mass values of $0.030m_0$ for the electrons and $0.060m_0$ for the holes. These are in substantial agreement with those calculated from cyclotron resonance and from the temperature dependence of the susceptibility de Haas-van Alphen oscillations. Corresponding Fermi energies were found to be 0.018 ev for the electrons and 0.012 ev for the holes, giving a very slight band overlap in graphite of 0.030 ev. (auth)

4044

ANALYSIS OF MULTICARRIER GALVANOMAGNETIC DATA FOR GRAPHITE. J. W. McClure (National Car-

bon Co., Cleveland). Phys. Rev. 112, 715-21(1958) Nov. 1.

The magnetic-field-dependent data of Soule for the Hall effect and magnetoresistance in graphite were analyzed using a multicarrier model. An improved mode of analysis is used, in which the magnetoconductivity tensor elements are computed as functions of magnetic field strength from experimental data, and then fitted to simple formulas. The formulas represent solutions to the Boltzmann equation in the classical (nonoscillatory) range. The effects of electrons and holes are separated by applying a Kramers-Kronig type relation. The results, which agree with band-model predictions within 20 to 50%, are that there are 2.9×10^{18} holes and electrons per cm^3 in pure graphite at 4.2°K, and 7.0×10^{18} cm^{-3} each at 300°K. The mobilities range from about 9×10^5 cm^2/volt sec at 4.2°K to 1.0×10^4 cm^2/volt sec at 300°K, with the hole-to-electron mobility ratio being 1.2 and 0.9 at the two temperatures. In addition, at room temperatures there are about 6×10^{14} minority holes per cm^3 with a mobility of 15×10^5 cm^2/volt sec and 5×10^{14} minority electrons per cm^3 with a mobility 4×10^5 cm^2/colt sec. The relaxation times for the majority carriers are distributed over a range of a factor of four. The average relaxation times are consistent with those deduced from cyclotron resonance experiments. (auth)

4045

MAGNETIC STRUCTURE OF Fe_4N. B. C. Frazer (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 112, 751-4(1958) Nov. 1.

The magnetic structure of Fe_4N was examined in a neutron diffraction study. The results are in agreement with a model proposed by Wiener and Berger on the basis of magnetic measurements on a series of related compounds. Ferromagnetically aligned moments of 3 μ_B and 2 μ_B are found for the corner and face-center Fe atoms (respectively) in the cubic unit cell. The difference in moments is apparently due to bonding interaction between nitrogen, at the body-center position, and the face-center Fe's. (auth)

4046

GENERAL IMPACT THEORY OF PRESSURE BROADENING. Michel Baranger (Carnegie Inst. of Tech., Pittsburgh, and RAND Corp., Santa Monica, Calif.). Phys. Rev. 112, 855-65(1958) Nov. 1.

The work of two previous papers is extended and a theory of pressure broadening is developed which treats the perturbers quantum mechanically and allows for inelastic collisions, degeneracy, and overlapping lines. The impact approximation is used. It consists in assuming that it takes, on the average, many collisions to produce an appreciable disturbance in the wave function of the atom, and it results in an isolated line having a Lorentz shape. Validity criteria are given. When the approximation is valid, it is allowable to replace the exact, fluctuating interaction of the perturbers with the atom by a constant effective interaction. The effective interaction is expressed in terms of the one-perturber quantum mechanical transition amplitudes on and near the energy shell and its close relationship to the scattering matrix is stressed. The calculation of the line shape in terms of the effective interaction is the same as when the perturbers move on classical paths. Results are written explicitly for isolated lines. If the interaction of the perturbers with the final state can be neglected, the shift and width are proportional to the real and imaginary part of the forward elastic scattering amplitude, respectively. By the optical theorem, the width can also be written in terms of the total cross section. When the interaction in the final state cannot be neglected, the shift and width are still given in terms of the elastic scattering amplitudes, in a slightly more complicated fashion. Finally, rules are given for taking into account rotational degeneracy of the radiating states. (auth)

4047

RECOIL EFFECT IN BETA DECAY AND K CAPTURE. Claude C. Bouchiat (Princeton Univ., N. J.). Phys. Rev. 112, 877-89(1958) Nov. 1.

The study of recoil effects in β decay and K capture is extended to the case of forbidden transitions. Formulas for the angular distribution of recoil nuclei from oriented parent nuclei, the polarization of the recoil nucleus, and the angular correlation between the recoil nucleus and the following γ ray emitted in given state of circular polarization are presented. For β decay the results, in which the Coulomb effects have been taken into account only through the Fermi function, are given in closed form for n-forbidden transitions. We have considered separately ST and VA interactions. The results are quite sensitive to the choice between the two couplings. In particular it is shown that for the so-called unique forbidden transitions of light-nuclei parity-nonconserving effects vanish for a VA interaction, whereas they are expected to be large with an ST interaction. The study of recoil effects in K capture, which has been limited to the case of first forbidden transitions, provides a set of experiments which may be used to determine the helicity of the neutrino. (auth)

4048

LIFETIMES OF THE FIRST EXCITED STATES OF F^{17} AND B^{10}. R. E. Holland, Frank L. Lynch, and S. S. Hanna (Argonne National Lab., Lemont, Ill.). Phys. Rev. 112, 903-5(1958) Nov. 1.

The mean life of the first excited state of F^{17} was measured using a pulsed-beam technique. The mean life is definitely <0.5 mμsec. The result obtained is (0.35 ± 0.15) mμsec with the upper limit more firmly established than the lower. A value of 495 ± 15 kev was obtained for the excitation energy in F^{17}. A measurement of the mean life of the first excited state of B^{10} gave a value of (0.90 ± 0.1 mμsec. (auth)

4049

PARAMAGNETIC RESONANCE OF TERBIUM IN NITRATE. T. I. Sanadze, M. Kolach, and G. A. Tsintsadze. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 271(1957). (In Russian)

The paramagnetic resonance spectrum of Tb^{3+} ion was observed in lanthanum nitrate monocrystal containing 0.1% terbium nitrate. The spectrum consisted of a single electron transition spallated into four lines corresponding to Tb^{159} nuclear spin 3/2. Measurements were made at 13°K and 8970 and 9870 mc. (R.V.J.)

4050

THE CRITICAL EFFECT OF GEOMETRIC DIMENSIONS OF A SYSTEM EXTENDING A HIGH-FREQUENCY PROTON SOURCE ON THE IONIC BEAM. M. D. Gabovich and G. P. P'yankov (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 419-20(1958) May–June. (In Russian)

Effects of a magnetic field on a high-frequency proton source, with resonance perpendicular to the field directed along the axis of ion expansion and the coil of

high-frequency circuit perpendicular to the axis, are studied. A graphic expression of such expansion is plotted in order to determine the effects of geometric dimensions on the force of ion beam flux. (R.V.J.)

4051

SIMPLE WAVES IN MAGNETIC HYDRODYNAMICS. A. I. Akhiezer, G. Y. Lyubarskii, and R. V. Polovin (Kharkov State Univ.). Ukrain. Fiz. Zhur. 3, 433-8 (1958). (In Ukrainian)

The connection between simple and linearized plane waves is investigated. All simple waves in magnetic hydrodynamics are found. It is shown that in magneto-hydrodynamics, as in ordinary hydrodynamics, the region of constant flow may border only on a simple wave in the absence of shock waves. (tr-auth)

4052

DOUBLE PARAMAGNETIC RESONANCE OF CRYSTAL INCORPORATED ATOMS AND F-CENTERS IN MIXED CRYSTALS. M. F. Deigen and A. B. Roitsin (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 446-8(1958). (In Ukrainian)

The dependence of the frequencies of spin-nucleus transitions in a crystal containing local electron centers on the orientation of the crystal in an external static magnetic field was analyzed. The respective angular dependences of spin-nucleus transitions in F centers of pure and mixed crystals, as well as in incorporated atoms in NaCl and CdS type crystals, are discussed as examples. The results obtained permit the determination with great precision the value of the square of the localized electron wave function at various lattice points, and to judge the environment of the defect (short order). (tr-auth)

4053

MODEL OF A QUANTUM HARMONIC OSCILLATOR WITH FRICTION IN DISPERSION THEORY. L. A. Shulman and N. Yu. Deinker (Lenin Tadzhik State Univ.). Ukrain. Fiz. Zhur. 3, 455-9(1958). (In Ukrainian)

The Hamiltonian of a quantum harmonic oscillator with friction interacting with an incident light wave was developed. The Hamiltonian obtained is applied for the construction of a theory of dispersion with absorption. This calculation proved to be simpler than a consecutive calculation by the methods of quantum electrodynamics. The calculation yields an expression for the atomic polarization of the system as a function of frequency. (tr-auth)

4054

INVESTIGATION OF A THERMALLY EXCITED CURRENT IN CdS MONOCRYSTALS. A. P. Trofimenko and G. A. Fedorus (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 468-74(1958). (In Ukrainian)

The effect of thermal excitation of current in CdS monocrystals within a temperature range of −210 to +150°C was studied. It is shown that the curves of a thermally excited current for unannealed specimens have several (from 2 to 6) maxima; the value and position of these maxima may vary for different crystals. A study of CdS monocrystals to which an admixture of some metal was added showed that, along with the first low-temperature maximum, there appears a second maximum at a higher temperature. The results obtained permit the approximate determination of the position of certain local levels in the prohibited zone of CdS. (tr-auth)

4055

EFFECT OF AN ELECTRICAL FIELD ON THE HALL EFFECT IN Ge AT VARIOUS TEMPERATURES. T. M. Sitenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 479-81(1958). (In Ukrainian)

The effect of an external electric field on the conductivity and Hall effect in germanium samples at various temperatures was studied. It is shown that the conductivity curves $\Delta\sigma = f(E_y)$ and the Hall effect $\Delta R_x = f(E_y)$ at various temperatures pass through extremes with unequal values of the external electric field. The last is evidently connected with the dependence of the bending of the zones at the surface on the specimen temperature. (tr-auth)

4056

IMPORTANT PROBLEM IN MODERN PHYSICS. (EXCITON IN CRYSTALLINE LATTICE). E. F. Gross. Vestnik Akad. Nauk S.S.S.R. 28, No. 10, 11-19(1958) Oct. (In Russian)

The formation of excitons and their importance in physical phenomena of crystal lattices is analyzed. The quasi-particles which carry the excitons from the point of their origin to other points in the crystal should be of paramount importance to the optical spectra of crystals, magnetic and electro-optical properties, luminescence, and internal and external photoelectric effect. (R.V.J.)

4057

ENERGY OF THE X-RAY RADIATION EMITTED BY A POWERFUL PULSED DISCHARGE IN HYDROGEN. N. G. Kovalskii, I. M. Podgornii, and S. Khvashchevskii. Zhur. Eksptl'. i Teoret. Fiz. 35, 940-6(1958) Oct. (In Russian)

The maximal energy of x-ray quanta emitted during a powerful pulsed discharge in hydrogen was determined. The energy values presented were derived by analysis of the recoil electron spectrum measured with a cloud chamber. (tr-auth)

4058

ON PROPAGATION OF ELECTROMAGNETIC WAVES IN A MEDIUM WITH ACCOUNT OF SPATIAL DISPERSION. V. M. Agranovich and A. A. Rukhadze. Zhur. Eksptl'. i Teoret. Fiz. 35, 982-4(1958) Oct. (In Russian)

A method for investigating electromagnetic waves in a medium with spatial dispersion, which is more refined than the method proposed by Ginzburg, is presented. Expansions of the ≪direct≫ and ≪inverse≫ spatial dispersions were obtained. (tr-auth)

4059

BEHAVIOR OF ARBITRARY SPIN PARTICLES IN AN EXTERNAL MAGNETIC FIELD. V. S. Popov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 985-8 (1958) Oct. (In Russian)

A method of disentangling, proposed by Feynman, is employed to solve the problem of change in an external field of the polarization of a particle possessing a magnetic moment. (tr-auth)

4060

THE POMERANCHUK EFFECT AND THE PHASE DIAGRAM OF He^3—He^4 SOLUTIONS. I. M. Lifshitz and D. G. Sanikidze (Khar'kov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1020-25(1958) Oct. (In Russian)

The influence of the Pomeranchuk effect on equilibrium of the liquid and solid phases of He^3—He^4 solutions is investigated thermodynamically. (tr-auth)

4061
ON THE MULTIPLE INTERACTION IN QUANTUM FIELD THEORY. L. I. Podlubnyi (Odessa Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1044-5(1958) Oct. (In Russian)

An expression was derived for the effective potential of multiple interaction of two particles. (R.V.J.)

4062
INVESTIGATION OF ENERGY POSITIONS AND EFFECTIVE CAPTURE CROSS SECTIONS OF SURFACE RECOMBINATION LEVELS IN GERMANIUM. A. V. Rzhanov, N. M. Pavlov, and M. A. Selezneva. Zhur. Tekh. Fiz. 28, 2645-56(1958). (In Russian)

The effects of vacuum heating and ozone action on surface level recombination in Ge were studied. Preliminary data are given on the temperature dependence of the energy position and the effective cross sections of vacancy and electron capture by these levels. The dependence of these characteristics on the amplitude of the transverse field is shown. The influence of the charge, captured by the slow surface levels, on the recombination character of the surface levels is discussed. The obtained data indicate that the nature of level recombination appearing in vacuum heating and in ozone action is the same. (tr-auth)

4063
THE NUCLEAR HANDBOOK. O. R. Frisch. London, George Newnes Limited, 1958. 650p.

This is a reference book in the field of nuclear physics. The volume is divided into 19 sections: concepts in nuclear physics, radiation effects and protection, elements and isotopes, natural radioactivity, materials, vacuum, particle accelerators, x-rays and gamma rays, neutrons, fission products and transuranic elements, reactors, chemistry, ion chambers and computers, electronics, deflection techniques and magnetic materials, cloud and bubble chambers, nuclear emulsions, and nuclear reactions. (W.L.H.)

4064
INVESTIGATION OF AN IONIZED GAS BY MEANS OF WEAK ELECTRIC ALTERNATING FIELDS. 2. PRODUCTION OF FORCED OSCILLATIONS IN THE INTERIOR OF THE GAS. Angelika Székely (Univ. of Graz, Austria). Acta Phys. Austriaca 12, 155-71(1958). (In German)

The conductance and capacitance of a condenser which is filled with the plasma of a glowing cathode low-pressure discharge have abnormal values at numerous frequencies in the range from 1 to 10 MHz. It was determined that the curve of the dependence of the anode current deviates from normal patterns. For clarification it was assumed that forced oscillations were produced in the interior of the gas by the measuring voltage. The curves on the frequency dependence of the conductance and capacitance in the anode current permit the detection of two resonances which lie in the frequency at which weak self-excited oscillations are observed. It was concluded that in the range of these frequencies ordered forced oscillations of the plasma electrons occur under the influence of the measuring voltage since the ionization condenser behaves as a quartz oscillator. The conductance has a maximum at the resonance and increases sharply over the normal without oscillation to the expected value. The capacitance variation is zero at the resonance and has varying signs before and after the resonance. In a schematic form the comparison of the plasma with the quartz oscillator was used for the introduction of the piezo and elasticity modulus, from which it is shown that the eigen frequency of the plasma was determined by the electric field strength in the plasma surface layer, the lower in the cathode side surface layer, the higher in the surface layer in the face of the condenser. In addition to the ordered oscillations of the plasma electrons unordered oscillations were produced by the measuring voltage; such unordered oscillations must be considered for the clarification of the lowering of the conductance under the normal value in the frequency range around 3 MHz. (tr-auth)

Elementary Particles

4065 CERN-58-26
European Organization for Nuclear Research, Geneva.
PRODUCTION D'ANTIHYPERONS ET TESTS DE LA SYMETRIE GLOBALE. (Production of Antihyperons and Tests of Global Symmetry.) B. d'Espagnat and J. Prentki. Oct. 1958. 24p.

An elementary introduction to the hypothesis of total symmetry in π interactions is given. The theoretical study is followed by the examination of some experiments which might prove or disprove the hypothesis of total symmetry. (J.S.R.)

4066 NEVIS-56
Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.
STUDY OF CONSERVATION LAWS IN THE PI–MU–ELECTRON DECAY CHAIN. Marcel Weinrich. Feb. 1958. 42p. Contracts N6-ori-110-Task No. 1 and AT(30-1)-1932. (CU-151-58-ONR-110-Phys.). $7.80 (ph OTS); $3.30(mf OTS).

The conservation laws in weak interactions are investigated through a study of the asymmetry in the angular distribution of the β decay of μ^+ obtained from the decay of π mesons. The large front-to-back asymmetry observed proves that parity is not conserved in both π and μ decays and shows that charge conjugation is also not conserved. The magnetic moment of μ was obtained and the g-factor found to be $g = 2.06 \pm 0.15$. The energy dependence of the asymmetry is studied, and the results are compared with the predictions of the two component neutrino theory. Finally, a beam of polarized μ mesons is used for the study of the depolarizing effect of various materials. (auth)

4067 NP-7061
Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
ON ESTIMATION OF CONTRIBUTION OF NUCLEON-ANTINUCLEON INTERACTION TO DISPERSION RELATION FOR NUCLEON-NUCLEON SCATTERING. L. I. Lapidus. 1958. 11p.

The relations between the scattering lengths and the effective radii in the S, P states, following from the dispersion relations for N-N scattering, are considered. The estimations of the contribution of N-N interaction to the dispersion relations for N-N scattering were obtained by means of experimental data for n-p and p-p scattering at low energies. This contribution is not large. Its value depends on a sign of scattering lengths in the S states. (auth)

4068 UCRL-4927-T
California. Univ., Livermore. Radiation Lab.
ELASTIC SCATTERING OF 7 MEV NEUTRONS

(THEORETICAL CURVES). F. Bjorklund and S. Fernbach. July 1957. 42p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

Theoretical differential cross sections computed from the optical model for 7-Mev neutrons are presented for a large number of nuclei. The parameters used for the calculations were selected on the basis of best fit to existing experimental data. (auth)

4069

ON METHODS FOR MEASURING CONCENTRATIONS OF SLOW NEUTRONS IN THE F_2 LAYER OF THE IONOSPHERE. V. N. Kessenikh. Doklady Akad. Nauk S.S.S.R. 123, 57-9(1958) Nov. 1. (In Russian)

Tentative calculations show that with neutron concentrations of 1 cm^{-3}, 0.5 Mev electrons produced in neutron decay are captured by the earth's magnetic field and moved along a 70-m radius helicoidal trajectories. These electrons can produce up to 1.5×10^4 secondary electrons for each primary. With a neutron half life of 720 sec and neutron concentrations of 1 cm^{-3}, the number of 0.5 Mev primary electrons is 10^{-3} cm^{-3}. Methods for measuring slow neutron components of cosmic radiation with non-screened counters with BF_3 enriched with B^{10} permit recordings of neutron flux with 1.0 sec^{-1} cm^{-2} density. The neutron counter, erected in an artificial earth satellite, should record the slow neutron concentrations of 1 cm^{-3} order. Analysis of the available data indicates the feasibility of measuring neutron concentrations up to 10^{-7} cm^{-3} by means of non-screened counters with BF_3 mounted in orbital installations moving in the upper atmosphere. (R.V.J.)

4070

DIRECT PRODUCTION OF ELECTRON PAIRS BY HIGH ENERGY ELECTRONS. R. Weill (Laboratoire de Recherches Nucléaires, E.P.U.L., Lausanne, Switzerland). Helv. Phys. Acta 31, 641-60(1958). (In French)

The methods of energy measurement of electron pairs were improved. The limits of application of direct angle measurements were recalculated, and the three dimensional model of track formation, which accounts for the variation of ionization on the initial track of electron pairs, was perfected. These results confirm the energy measurements made for the determination of the mean free path λ of direct electron pairs production. It was found that the Kaplon and Koshiba factor f_1 used for the calculation of the number of pseudotridents is too large. This can introduce an overestimation on λ up to four times at 100 Gev. If the disagreement between Bhabha and Racah's theoretical values and the experimental determination of λ seem to be established, the values deduced from Stueckelberg's remark agree quite well with the experiment. The influence of 'anomalous' trident production on shower development was also calculated. (auth)

4071

ON THE ELECTRON PRODUCTION RATE IN THE F_2 REGION OF THE IONOSPHERE. S. Datta (Inst. of Radio Physics and Electronics, Calcutta). Indian J. Phys. 32, 483-91(1958) Oct.

A column of unit cross section of the F_2 region extending from the "bottom" to the height of its maximum electron density is divided into four columns of equal length. Mean production rate in each of the columns is calculated. For this purpose, diurnal variation of the total number of electrons in each of the columns and the height variation of the attachment coefficient suggested by Ratcliffe et al (1956) are utilized. This method of computation leads to a regular consistent diurnal variation of the electron production rate with a single peak at about half an hour before noon time and eliminates the anomalous results that are sometimes obtained when other methods of computation are employed. (auth)

4072

AIR SHOWERS OF SIZE GREATER THAN 10^5 PARTICLES. 4. THE DISTRIBUTION OF NUCLEAR ACTIVE PARTICLES AND OF MU-MESONS. J. A. Lehane, D. D. Millar, and M. H. Rathgeber (Univ. of Sydney). Nature 182, 1699-1704(1958) Dec. 20.

A study was made of the nucleon and μ-meson density distribution for showers of size 5×10^4 to 2×10^6 scintillator particles out to distances of 40 m from the shower core. There is no significant evidence that the forms of the distribution functions change with shower size, although additional statistics will be required in order to determine whether this is really the case. On the assumption of a constant form for the radial structure function, the number of μ-mesons in the showers recorded varies as $N^{0.4\pm0.1}$ and of nucleons, as $N^{0.8\pm0.1}$, within the range of shower sizes investigated. Comparison with similar experimental observations at mountain altitude indicates, on this assumption, that the attenuation-length of nucleons and of μ-mesons is longer in small showers than in large. A comparison has been made with the theoretical results of Ueda and Ogita for one primary of energy 10^{15} ev and this leads to agreement with a value of 0.3 for the inelasticity of the high-energy collisions of the nucleon cascade. (auth)

4073

ELECTRON ACCELERATION AGAINST AN OPPOSING FIELD IN A VACUUM ELECTROMAGNETIC DISCHARGE. Joseph Slepian. Phys. Fluids 1, 547-8(1958) Nov.-Dec.

In a vacuum in a magnetic field, tenths of an ampere of electrons were brought out continuously, from a state where initially their kinetic energy was a hundred volts or more, by a discharge of a few hundred volts but in a direction to oppose the motion of electrons. An explanation is offered for this apparent paradox. (A.C.)

4074

DECAY OF LITHIUM-7 HYPERNUCLEUS. P. H. Fowler (Univ. of Bristol, Eng.). Phil. Mag. 3, 1460-2(1958) Dec.

An event found in a stack of 600 μ Ilford K5 emulsion exposed to a separated beam of K^- particles is interpreted as the decay of ${}_{\Lambda}Li^7$. It gives a value of 5.2 ± 0.5 Mev for the binding energy of the Λ^0. In addition, it is almost certain that the Λ^0 hyperon was produced directly from the capture of the K^- meson by O^{16}. (J.H.M.)

4075

INVERSE BETA DECAY AND THE TWO-COMPONENT NEUTRINO. R. W. King (Purdue Univ., Lafayette, Ind.) and J. F. Perkins (Lockheed Aircraft Corp., Marietta, Ga.). Phys. Rev. 112, 963-6(1958) Nov. 1.

Several procedures for calculating the average cross section per antineutrino from U^{235} fission are given to test the predictions of the two-component neutrino theory. A firm lower limit of $\bar{\sigma}_p = 7 \times 10^{-44}$ cm^2 is deduced from the known decays of the fission products. Three different procedures, if weighted equally, give a "best value" of $\bar{\sigma}_p = 14 \times 10^{-44} cm^2$ to be compared with the recently increased experimental value $\bar{\sigma}_p = 11 \pm 4 \times 10^{-44}$ cm^2. It is concluded that predictions of the two-

component neutrino theory are in accord with the experimental results on inverse beta decay. (auth)

4076

LEPTONIC DECAY MODES OF THE HYPERONS. F. Eisler, R. Plano, A. Prodell, et al. (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 112, 979-81(1958) Nov. 1.

A search was made for the leptonic decay of the Λ^0 and Σ^-. The sensitivity of the experiment was such that 5 to 6 events should have been found according to the predictions of the "universal" V-A model of β decay. No examples of leptonic decay were observed. (auth)

4077

PION-HYPERON SCATTERING AND K^--p REACTIONS. Marc Ross (Indiana Univ., Bloomington). Phys. Rev. 112, 986-91(1958) Nov. 1.

A brief survey is made of the consequences of the universal pion-baryon interaction on production of hyperons with pions. In particular, a pion-hyperon resonant scattering state similar to the $p_{3/2}$, $T = 3/2$ pion-nucleon state should exist. Possible effects of this state are examined. It is found that the large low-energy K^--p cross sections cannot be associated with it. Other experiments are suggested in order to search for this state, especially K^--p reactions at higher energy and pion production in hyperon-nucleon scattering. (auth)

4078

INTERNAL PAIRS IN THE CAPTURE OF π^- BY PROTONS. Ronald M. Rockmore and John G. Taylor (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 112, 992-4(1958) Nov. 1.

The contribution from nucleon structure to the process $\pi^- + p \rightarrow n + e + e^+$ is calculated. The dispersion relations for photoproduction of π mesons by virtual photons together with crossing symmetry are used. The nucleon structure contribution is found to be of the order of 2% and of the same size as the contribution from longitudinal polarization. The effect cannot be detected from present data. A 25% discrepancy between theory and experiment, which results from using the more reliable Panofsky ratio 1.8, still persists. (auth)

4079

NEUTRAL VECTOR MESON AND NUCLEON FORM FACTORS AND MAGNETIC MOMENTS. Robert W. Huff (Univ. of Chicago). Phys. Rev. 112, 1021-6(1958) Nov. 1.

The existence of the heavy neutral vector meson recently suggested by Nambu is studied as a possible explanation of two phenomena: (1) the small charge root-mean-square radius of the neutron, and (2) the nucleon anomalous magnetic moments. The types and strengths of its interactions required to account for these phenomena are then used to predict the modes and rates of its decay as a function of its mass. The possibility of its detection by observation of these decay products is briefly discussed. Results are inconclusive. (auth)

4080

MESON EXCHANGE EFFECTS IN TWO-NUCLEON STATES. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 112, 1027-38(1958) Nov. 1.

It is suggested that the most fruitful study of meson exchange effects requires a unified treatment of all processes in which they occur. A new representation of the eigenstates of the two-nucleon system, based on the Heitler-London method, is proposed as being particularly useful for this purpose. Heitler-London states have the property that they become equal to the exact eigenstates when the two nucleons are far apart. Matrix elements between Heitler-London states can be expressed in terms of the properties of isolated nucleons, by means of expansions in the number of exchanged mesons. The Heitler-London method affords a mathematically precise method of incorporating phenomenological isobar effects into a field-theoretical model. Most of the discussion of the details of the formalism is confined to the fixed-source model, but in the final part of the paper the application to a more general model is discussed briefly. (auth)

4081

RIGOROUS VALIDITY CRITERION FOR TESTING APPROXIMATIONS TO THE ELECTRON GAS CORRELATION ENERGY. Richard A. Ferrell (Univ. of Maryland, College Park). Phys. Rev. Letters 1, 443-5(1958) Dec. 15.

Since approximations are involved in attempts to obtain expressions for the ground state energy of a degenerate electron gas, it is desirable to have rigorous checks on the results. A theorem is given which provides one such a priori restriction. The theorem is: The lowest eigenvalue of a Hermitian operator which contains a parameter linearly has a nonpositive second derivative with respect to the parameter. A specific case is given which points out the validity of the theorem. (T.B.A.)

4082

ELECTROMAGNETIC MASS CORRECTION FOR SPIN 0 PARTICLES. S. Gasiorowicz and A. Petermann (CERN, Geneva). Phys. Rev. Letters 1, 457-8(1958) Dec. 15.

4083

PHOTOPRODUCTION OF SINGLE POSITIVE PIONS FROM HYDROGEN IN THE 600- TO 1000-Mev REGION. F. P. Dixon and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. Letters 1, 458-60(1958) Dec. 15.

Magnetic spectrometer measurements of pions from the reactions $\gamma + p \rightarrow \pi + n$, initiated by a bremsstrahlung beam in a liquid hydrogen target, have been extended to cover a range of 20° to about 163° in the center-of-momentum system for laboratory photon energies of 0.6, 0.7, 0.8, 0.9, and 1 Bev. Angular distribution and total cross section data are given. (T.B.A.)

4084

POLARIZATION OF RaE ELECTRONS. H. Wegener, H. Bienlein, and H. v. Issendorff (Univ. of Erlangen, Ger.). Phys. Rev. Letters 1, 460-1(1958) Dec. 15.

The longitudinal polarization for RaE has been measured by Mott scattering after deflection through an electric field. The results for the degree of longitudinal polarization of RaE electrons are $P/(-v/c) = 0.69 \pm 0.04$, 0.75 ± 0.04, 0.75 ± 0.04, and 0.66 ± 0.06 for E = 120, 155, 209, and 290 kev. (T.B.A.)

4085

SYMMETRIES IN BARYON-K MESON INTERACTIONS. Y. Shimamoto (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 1, 463-5(1958) Dec. 15.

4086

ELASTIC SCATTERING OF PHOTONS BY TANTALUM. E. G. Fuller and Evans Hayward (National Bureau of Standards, Washington). Phys. Rev. Letters 1, 465-7 (1958) Dec. 15.

Results are described of a measurement of the differential cross section at 120° for the elastic scattering

of photons by tantalum. The experimental cross section as a function of energy is in better agreement with the result calculated from the tensor expression than that obtained assuming a scalar polarizability. This tends to confirm the spatial correlation of the dipole polarizability for a deformed nucleus. (T.B.A.)

4087

DOUBLING OF FERMIONS. M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 1, 467-8(1958) Dec. 15.

Although the baryons possess strong interactions, in addition to the electromagnetic and weak ones, it is conceivable that whatever the cause of the doubling of electrons into light and heavy ones might also be responsible for a doubling of baryons. Considerations are given to the interactions which could possibly give rise to the doublets and to the characteristics which may help distinguish the unknown particle from the known. (T.B.A.)

4088

MUON K-CAPTURE COMPARED TO β DECAY FOR $C^{12} \rightleftharpoons B^{12}$. J. O. Burgman, J. Fischer, et al. (CERN, Geneva). Phys. Rev. Letters 1, 469-71(1958) Dec. 15.

In order to compare the coupling strengths of electrons and muons to nuclei, the rate ratio $(C^{12} + \mu^- \rightarrow B^{12} + \nu)/(C^{12} + e^- \leftarrow B^{12} + \nu)$ was determined. A value of 1.37 ± 0.08 was obtained. The experimental procedure is explained. (T.B.A.)

4089

MEASUREMENT OF THE ASYMMETRY PARAMETER IN μ-e DECAY. Gerald Lynch and J. Orear (Cornell Univ., Ithaca, N. Y.) and S. Rosendorff (Columbia Univ., New York). Phys. Rev. Letters 1, 471-2(1958) Dec. 15.

The asymmetry parameter in μ-e decay was measured in a situation in which polarization (P) was very nearly equal to unity. From the 10,791 recorded events, the corrected asymmetry parameter is $a = -0.298 \pm 0.019$. This corresponds to $P\xi = -0.89 \pm 06$, which is 1.8 standard deviations below the theoretical prediction of $\xi = -1$. (T.B.A.)

4090

NEUTRON-PROTON MASS DIFFERENCE BY DISPERSION THEORY. M. Cini, E. Ferrari, and R. Gatto (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Phys. Rev. Letters 2, 7-9(1959) Jan. 1.

The problem of neutron–proton mass difference is examined by using as a basis the expression of the Compton scattering amplitude derived with a dispersion relation approach. (J.H.M.)

4091

FURTHER SEARCH FOR PARITY NONCONSERVATION IN ASSOCIATED PRODUCTION. Frank S. Crawford, Jr., Marcello Cresti, Myron L. Good, et al. (Univ. of California, Berkeley). Phys. Rev. Letters 2, 11-12 (1959) Jan. 1.

Information is reported on the analysis of 185 events of the type $\pi^- + p \rightarrow \Lambda^0 + K^0$ and $\Lambda^0 \rightarrow p + \pi^-$, produced by pions of 1.23 bev/c, leading to 375 Mev/c Λ's in the c.m. system. (J.H.M.)

4092

ISOTOPIC SPIN SELECTION RULES AND K_2^0 DECAY. S. Okubo and R. E. Marshak (Univ. of Rochester, N. Y.) and E. C. G. Sudarshan (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters 2, 12-14(1959) Jan. 1.

A theoretical investigation was made to determine whether or not there exists some kind of isotopic spin selection rule for the decays of strange particles. In this study, it was shown that if the extended $\Delta I = \frac{1}{2}$ selection rule is true for both leptonic and nonleptonic modes, then one can calculate almost uniquely the lifetime of K_2^0 and the various branching ratios of K_2^0 from the know decay rates of K^+ decay. (J.H.M.)

4093

MEASUREMENT OF ELECTRON BEAM ENERGY USING A GAS ČERENKOV DETECTOR. M. R. Bhiday, R. E. Jennings, and P. I. P. Kalmus (University Coll., London). Proc. Phys. Soc. (London) 72, 973-80(1958) Dec. 1.

It is shown that the energy of a monoenergetic beam of fast electrons can be accurately determined by using a variable pressure gas Cherenkov detector. A description of a simple detector of this type, and results taken with a $4\frac{1}{2}$ Mev electron beam, are given. (auth)

4094

POLARIZATION OF μ-MESONS SCATTERED BY MERCURY. G. E. Brown (Univ. of Birmingham Eng.), L. R. B. Elton (Battersea Coll. of Tech., Eng.) and F. Mandl (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Phys. Soc. (London) 72, 1137-41(1958) Dec. 1.

Calculations for the scattering by mercury of μ^+ and μ^- mesons of velocity 0.8c are reported. Results are given for the cross section and polarization of Mott scattering and scattering by extended charge distribution. Semi-classical considerations are given to the understanding of some of the results. (J.H.M.)

4095

THEORY OF BLOCH ELECTRONS IN A MAGNETIC FIELD. W. Kohn (Imperial Coll. of Science and Tech., London). Proc. Phys. Soc. (London) 72, 1147-50(1958) Dec. 1.

Information is presented on the theory of Bloch electrons in a magnetic field that might clarify some contradictory conclusions reached in previous works. Considerations are given to energy levels corresponding to closed classical orbits and energy levels corresponding to open classical trajectories. (J.H.M.)

4096

MULTIPLE SCATTERING OF RELATIVISTIC PARTICLES IN A FILTER BETWEEN TWO COLLIMATORS. G. I. Kopylov and M. I. Podgoretskii (Joint Inst. of Nuclear Research). Pribory i Tekh. Eksp. No. 4, 22-3 (1958) July-Aug. (In Russian)

The elongation of the fast charged particle range induced by multiple scattering in the filter between two collimators was investigated. (tr-auth)

4097

ON DEVELOPING TENSOR EXPRESSIONS WITH WAVE FUNCTION COMPONENTS. G. R. Khutsishvali. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 23-7(1957). (In Russian)

Tensor expressions for elementary particle processes were developed with wave function components instead of spinor components. (R.V.J.)

4098

DEUTERON–DEUTERON INTERACTIONS. V. I. Mamasakhlisov and T. G. Gachechiladze. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 29-35(1957). (In Russian)

Direct deuteron–deuteron interaction in $d(d,p)H^3$ reaction were investigated. (R.V.J.)

4099

MONTE CARLO METHOD IN CALCULATIONS OF

ELECTRON-PHOTON CASCADE INDUCED IN LEAD BY 500 Mev GAMMA QUANTA. V. V. Chavchanidze, R. S. Shaduri, and V. A. Kumsishvilli. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 37-52(1957). (In Russian)

A modified Monte Carlo method was used in calculations of electron-photon cascades induced by monochromatic, 500 Mev γ quanta in 0.5 cm thick lead plates. Methods used in programming computer calculations are described. (R.V.J.)

4100

EFFECT OF GEOMETRICAL DISTORTIONS OF THE CRYSTAL LATTICE ON X-RAY AND THERMAL NEUTRON SCATTERING BY MULTICONSTITUENT UNORDERED SOLID SOLUTIONS. M. A. Krivoglaz and E. A. Tikhonova (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Ukrain. Fiz. Zhur. 3, 297-312(1958) May-June. (In Russian)

Formulas were obtained which permit determining the intensity of diffuse scattering and weakening of the regular reflection intensity. Independent experimental data on the concentrational dependence of the dimensions and shape of the elementary cell, on the moduli of elasticity, and on the concentrational dependence of the chemical potentials were used in developing the formulas. The dependence of scattering intensity on the concentration of the constituents, the correlation parameters, and the difference between the wave vectors of the diffuse and incident waves is discussed. (tr-auth)

4101

ON THE ANGULAR DISTRIBUTION IN DEUTERON DIFFRACTION SCATTERING. I. I. Ivanchik (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 1050-2(1958) Oct. (In Russian)

A formula was derived for angular distribution in deuteron elastic scattering, suitable for all angular regions. (R.V.J.)

4102

INELASTIC SCATTERING OF 300 Mev POSITIVE AND NEGATIVE MESONS ON PHOTOGRAPHIC EMULSION NUCLEI. G. E. Belovitskii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 838-44(1958) Oct. (In Russian)

Results of measurement of the cross sections for inelastic scattering and of the angular distributions and energy spectra of inelastically scattered π^+- and π^--mesons of 300 Mev energy on photographic emulsion nuclei are presented. Some other characteristics of inelastic scattering also were obtained. (tr-auth)

4103

INVESTIGATION OF THE $n + p \rightarrow \pi^0 + d$ REACTION FOR 660 Mev EFFECTIVE ENERGY NEUTRONS AND THE HYPOTHESIS OF CHARGE INDEPENDENCE. V. B. Flyagin, V. P. Dzhelepov, et al. (Joint Inst. of Nuclear Research.). Zhur. Eksptl'. i Teoret. Fiz. 35, 854-67(1958) Oct. (In Russian)

The angular distribution and total cross section for production of π^0-mesons in the $n + p \rightarrow \pi^0 + d$ reaction was investigated for 660 Mev neutrons. An arrangement is employed which permits the recording of coincidences between one of the quanta of a decaying π^0 meson and the deuteron. Gamma quanta were recorded with a scintillation counter telescope containing a lead convertor. The deuterons were analyzed with a multi-channel magneitc spectrometer. The angular distribution thus obtained $(0.220 \pm 0.022) + \cos^2\theta$ (in the cms) and the total cross section for the reaction $(1.5 \pm 0.3) \times 10^{-27}$ cm^2 confirm the validity of the charge independence hypothesis. (tr-auth)

4104

INTERACTION OF 80-300 Mev π^+-MESONS WITH LIGHT NUCLEI. G. A. Blinov, M. F. Lomanov, et al. Zhur. Eksptl'. i Teoret. Fiz. 35, 880-6(1958) Oct. (In Russian)

A 17 liter bubble chamber was used to study the interaction between π^+-mesons and nuclei. Cross sections for scattering, absorption, charge-exchange, and generation of charged mesons were measured. Processes of absorption and charge-exchange are discussed. (tr-auth)

4105

BREMSSTRAHLUNG OF π^+-MESON INTERACTING WITH NUCLEI. M. F. Lomanov, A. G. Meshkovskii, et al. Zhur. Eksptl'. i Teoret. Fiz. 35, 887-93(1958) Oct. (In Russian)

Nuclear force bremsstrahlung of π^+-mesons was observed in a freon bubble chamber during the interaction between 80 to 300 Mev π^+-mesons with carbon, fluorine, and chlorine nuclei. The bremsstrahlung cross section in inelastic and elastic scattering of π^+-mesons deduced from 20 observed events was $(4.5 \pm \frac{1.2}{2.0}) \times 10^{-27}$ cm^2 per fluorine nucleus in the indicated energy region. Three events of bremsstrahlung were detected in the absorption of π^+-mesons by a nucleus and 2 cases can be ascribed to bremsstrahlung in charge-exchange scattering of π^+-mesons on the nucleus. The bremsstrahlung cross section for various nuclear processes was computed in the quasiclassical approximation. The values of the cross sections computed from these formulas are in good agreement with the experimental results. (tr-auth)

4106

INVESTIGATION OF DEPOLARIZATION OF NEGATIVE μ-MESONS IN LIQUID HYDROGEN. A. E. Ignatenko, L. B. Egorov, et al. (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 894-8(1958) Oct. (In Russian)

The angular distribution of decay electrons from μ^- mesons was measured in liquid hydrogen with scintillation counters. Within the limits of the experimental errors the distribution was found to be isotropic. The degree of polarization of μ^- mesons in mesic hydrogen was determined from the electron angular distribution data and found to be less 2.5%. The observed complete depolarization of μ^- mesons can evidently be explained in a sufficient degree by the mechanism suggested by Zeldovich and Gershtein according to which the μ^- meson jumps from one proton to another simultaneous with the transition to the hyperfine structure ground state. Due to this mechanism mutual transformation of orthohydrogen and parahydrogen is possible. It is impossible to determine the form of the interaction between μ^- mesons and nucleons by measuring the angular distribution of neutrons from the $\mu^- + p \rightarrow n + \nu$ reaction in liquid hydrogen because of total depolarization of the μ^- mesons. (tr-auth)

4107

INVESTIGATION OF THE INTERACTION BETWEEN 250 TO 270 Mev π^+-MESONS AND CARBON NUCLEI WITH AID OF A PROPANE BUBBLE CHAMBER. Wang Kan-chang, Wang Tso-tsiang, et al. (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 899-906(1958) Oct. (In Russian)

Interactions between 250 to 270 Mev π^+ mesons and carbon nuclei were measured with a propane bubble chamber. The total and differential cross sections for elastic and inelastic scattering of π^+ mesons as well as the total cross section for absorption and charge exchange of the π^+ mesons were determined. The prong distributions were obtained for stars containing mesons and for stars not containing mesons. Within the experimental errors, elastic scattering can be described by diffractional scattering for a nucleus with $K = 0.54 \times 10^{13}$ cm^{-1}, V = 30 Mev, and $R = 3.2 \times 10^{-13}$ cm. The inelastic scattering data confirm the assumption that mesons interact with separate nucleons in the nucleus and that the number of interactions in the carbon nucleus is not large. Analysis of stars not containing mesons permit one to assert that the absorption of a π^+-meson in the carbon nucleus and the subsequent decay of the π^+—C system cannot be explained on the basis of the evaporation model and so-called cascade process. (tr-auth)

4108

ON DEPOLARIZATION OF μ^+-MESONS IN METALS. I. V. Yakovleva (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 35, 970-3(1958) Oct. (In Russian)

Depolarization of μ^+ mesons in metals is investigated by assuming the formation of mesonium. It is shown that exchange interaction between the mesonium electron and electron fluid of the metal significantly decreases the depolarization of the μ^+ mesons. Under some reasonable assumptions regarding the dimensions of mesonium in the metal the estimates presented are found to be in satisfactory agreement with the experimental data. (tr-auth)

4109

ON DEPOLARIZATION OF μ^--MESONS IN HYDROGEN, DEUTERIUM AND TRITIUM. V. B. Belyaev and B. N. Zakharev (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 996-1000(1958) Oct. (In Russian)

Some effects which depolarize μ^- mesons in hydrogen, deuterium, and tritium are considered. Complete depolarization in hydrogen and tritium occurs before the mesic atom is slowed down to thermal energies. Depolarization probabilities are presented for capture in the K orbit of the mesic atom and for formation of mesic molecules. A correction $\sim\mu/M$ to account for motion of the nuclei was applied. The difference in the hyperfine structure levels were taken into account approximately. (tr-auth)

4110

ON THE APPLICATION OF THE BELEN'KII-TAMM EQUILIBRIUM SPECTRUM IN DEFINING γ n-REACTION EXCITATION FUNCTIONS. V. A. Shkoda-Ul'yanov (Uzhgorod State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1041-2(1958) Oct. (In Russian)

The cross sections of photoneutron reactions at 25 to 80 and 100 Mev were defined on the basis of the photon equilibrium spectrum appearing during the bombardment of a thick target by primary monochromatic electron beams. The number of photoneutrons produced can be linked to the photon equilibrium spectra by $\sigma_{\gamma N}(E)$. In the suggested method, electron beam monitoring achieves higher precision than in bremsstrahlung. (R.V.J.)

4111

ON THE LEVEL WIDTH OF π MESIC ATOMS. A. I. Lebedev (Lebedev Inst. of Physics). Zhur. Eksptl'. i Teoret. Fiz. 35, 1045-7(1958) Oct. (In Russian)

Considering the interactions of slow π^- mesons with nuclei as the perturbation to the Coulomb potential, it was possible to evaluate the meson—nucleus interaction potential. (R.V.J.)

4112

ON THE ANGULAR DISTRIBUTION OF HIGH ENERGY BROAD ATMOSPHERIC SHOWERS. V. V. Guseva, G. T. Zatsepin, G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 833-7(1958) Oct. (In Russian)

A cloud chamber and a large number of counters arranged in a hodoscope were employed to study the angular distribution of extensive atmospheric showers induced by extremely high energy electrons of $\gtrsim 10^{17}$ ev. The data thus obtained indicate that contrary to the conventional viewpoint, at mountain heights these showers have passed through their maximum of development. (tr-auth)

4113

ELEMENTARE NEUTRONENPHYSIK. (Elementary Neutron Physics). K. Wirtz and K. H. Beckurts. Berlin, Springer-Verlag, 1958. 250p.

A textbook intended to be used by students in connection with a laboratory course in neutron physics is presented. The first part of the book, which deals with neutron theory, covers physical properties of neutrons, neutron sources, neutron fields, elementary diffusion theory, neutron attenuation, and spatial distribution of attenuated neutrons. The second half of the book, which is concerned with the measurements of neutrons, discusses neutron detection, treatment of neutron probes, standardization of neutron measurements, stationary methods for the measurement of the diffusion length and the absorption cross section of weakly absorbing materials, neutron temperature in stationary fields, and pulsed neutron fields. An appendix presents data often used in neutron work. (J.S.R.)

4114

THE PHYSICS OF ELEMENTARY PARTICLES. J. D. Jackson. Princeton, N. J., Princeton University Press, 1958. 141p.

This volume is divided into three roughly equal parts. The first part is on low-energy pion physics, and covers the interaction of pions with nucleons at energies below 300 or 400 Mev. The second part presents the phenomena of K-mesons and hyperons and their interactions with nucleons. The final part treats decay processes, expecially the beta decay interactions, and summarizes the present status in that field. (W.L.H.)

Heat Transfer and Fluid Flow

4115 ANL-5949

Argonne National Lab., Lemont, Ill.

SOME PROBLEMS IN HORIZONTAL TWO-PHASE TWO-COMPONENT FLOW (thesis). Bobbie L. Richardson. Dec. 1958. 147p. Contract W-31-109-eng-38. $3.00 (OTS).

Submitted to Purdue Univ.

An experimental investigation was conducted on the flow of air—water mixtures in a number of horizontal rectangular Lucite test sections, whose aspect ratios varied from two to sixteen. These test sections were assembled in various combinations to permit the study of the effect of a sudden change in flow area on the significant flow parameters. A technique was developed for

measuring the volume fraction of each phase, making use of the difference of the attenuation characteristics of the liquid and the vapor for gamma radiation. This technique was evaluated making use of a number of Lucite mock-ups with known void distributions. Information is presented on the factors influencing the volume fractions, flow patterns, and slip ratios in the channels studied. The two-phase pressure drop is compared with existing correlations, and a relationship predicting this pressure drop, in terms of the liquid volume fraction, is derived. The energy losses associated with an abrupt expansion or contraction were studied. A correlation based on the experimental results is presented to permit the prediction of these losses. (auth)

4116 APEX-425

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

HEAT TRANSFER SOURCE FILE DATA. M. E. Lapides and M. B. Goldstein. Sept. 1957. 70p. Contracts AF33(600)-38062 and AT(11-1)-171. $2.00(OTS).

Turbulent flow of gases in various types of ducts is investigated. The discussion includes heat flux and mode of heat input effects, entrance region effects, duct cross-section effects, annular passages, heat transfer momentum analogies, and recommendations of analytical methods used on the duct configurations considered. Although the primary purpose of this report is to summarize available data and provide working correlations, considerable effort is devoted to theoretical interpretations. A narrative rather than a mathematical approach is employed. (auth)

4117 CF-58-11-67

Oak Ridge National Lab., Tenn.

HRT PURGE TUBE FLUID FLOW AND HEAT TRANSFER. H. A. McLain. Nov. 26, 1958. 26p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Since a continuous removal of solids from the screen area of the core during reactor operation is desired, a solution purge tube was designed for the HRT. Fluid flow studies show the flow rate through this tube is 1.3 gpm which is equivalent to 2.2 fps. For solid particles of a density of 5 g/cc, this flow will permit the removal of spheroids up to 0.007 in. diameter according to Stokes' Law. Heat transfer studies show that the purge tube when in operation will be sufficiently cooled during the operation of the reactor at full power (5 Mw), but it may be damaged upon stoppage of flow through it unless the reactor is lowered to heat loss power. The reactor may be operated at full power under the latter conditions, however, if a 0.200 in. diameter bleed hole is drilled in the purge tube wall near the top of the outlet pipe of the core. All the calculations assume that there is no deposition of uranium on the purge tube wall. Such deposition could cause hot spots which may result in damage to the purge tube. (auth)

4118 KAPL-M-D1G-TD-4(Pt. 1)

Knolls Atomic Power Lab., Schenectady, N. Y.

COMPILATION OF EXPERIMENTAL BURNOUT DATA AS OF MARCH 1958. Sheila A. Ryan, Carol A. Wagner, and J. Longo, Jr. Nov. 29, 1958. 89p. Contract W-31-109-Eng-52. $13.80(ph OTS); $4.80(mf OTS).

The results of investigations of departure from nucleate boiling (burnout) as of March 1958 are given. Only those results thought pertinent to the design of nuclear reactors are included. It is intended that this compilation can be of aid to reactor designers in predicting burnout conditions for a particular design. This is especially important since existing correlations are empirical and should be used only in the range of variables from which they were derived. (auth)

4119 NDA-2-79

Nuclear Development Corp. of America, White Plains, N. Y.

IMPROVED HEAT TRANSFER BY APPLICATION OF CENTRIFUGAL FORCES. Kurt Goldmann. June 25, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

Prepared for discussion during the Transient Boiling Session at the 1958 ASME-AICHE Heat Transfer Meeting.

A series of tests of the application of centrifugal forces to fluids to break up boundary layers, thereby increasing heat transfer coefficients, was conducted. The results indicate that these forces are effective in breaking up vapor films; however, increased velocities appear to be less effective in vapor film breakup. The test apparatus is described, and observations of the flow streams are included, as well as graphs of burnout fluxes vs. pumping power. (J.R.D.)

4120 SCTM-293-58(51)

Sandia Corp., Albuquerque, N. Mex.

AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE PRESSURE DISTRIBUTION AND PRESSURE DROP IN SMALL BORE TUBING USING AIR AT ELEVATED TEMPERATURES. Arnold L. Ducoffe. Oct. 15, 1958. 34p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

Analytical and experimental results of the flow of air through small bore tubing at approach temperatures ranging between 529 and 969°R are presented. Head pressures ranged from 14.7 to 50 psia for tubing lengths of 10 to 19.5 feet with inside diameters varying between 0.182 and 0.524 inch; approach velocity in all cases was negligible. (auth)

4121 WAPD-TM-456

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

NATURAL CONVECTION OF WATER AT 2000 PSIA WITH BOILING IN VERTICAL RECTANGULAR CHANNELS UNDER CONDITIONS OF ZERO-NET THROUGH FLOW. M. Troy. Oct. 1958. 25p. $4.80(ph OTS); $2.70(mf OTS).

Tests were run on water at 2000 psia under conditions of zero-net flow in vertical rectangular channels to determine the maximum heat flux that could be dissipated under such restricted conditions without resulting in an excessively high metal surface temperature. (W.L.H.)

4122

CONSIDERATIONS ON THE MECHANISM PROPOSED BY LEVENSPIEL AND WALTON FOR HEAT TRANSFER BETWEEN A FLUIDIZED BED AND A WALL. E. Ruckenstein and V. Schorr. Acad. rep. populare Romîne, Inst. energet. Studii cercetări energet. 8, 7-14 (1958). (In Rumanian)

Certain experimental results on heat transfer between a gas—oil fluidized bed and the wall of a tube led to the conclusion that from the Levenspiel-Walton model a somewhat different model could be constructed which would be in better accord with experimental data. At the basis of this model is found the hypothesis that the bed limit, formed near the wall, is destroyed at points of contact with solid particles, which are not considered fixed. An expression is obtained for the laminar case. The expression agrees with the experimental data. (tr-auth)

4123
HEAT TRANSFER IN THE CASE OF BOILING. E. Ruckenstein. Acad. rep populare Romîne, Inst. energet. Studii cercetări energet. 8, 15-20(1958). (In Rumanian)

The transmission of heat between the liquid and moving bubbles in the case of boiling is analyzed under conditions of free convection. The heat exchange between the bubbles and the small part of the liquid which remains in contact with the bubble during an interval of time τ is considered. An expression for the coefficient of heat transfer is obtained which gives values in agreement with experimental data. (tr-auth)

4124
GAMMASCOPIC METHODS IN STUDIES OF KINETICS OF FLUID FLOW IN A CAPILLARY-POROUS MATERIAL. V. N. Oleinikov and M. F. Kazanskii (Gorkii Pedagogical Inst.). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 2, 38-44(1958) Feb. (In Russian)

Descriptions are presented of an apparatus for investigating the kinetics of flow in a capillary-porous material. The sensitivity and advantages of the gammascopic method are described and demonstrated by graphical results. (tr-auth)

4125
AN INVESTIGATION OF THE PROCESSES OF HEAT TRANSFER IN HEAT EMANATING ELEMENTS OF A NUCLEAR REACTOR. V. S. Ermakov (Inst. of Power Engineering, Academy of Sciences, Belorussian SSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 9, 3-15 (1958) Sept. (In Russian)

A solution of differential equations for heat transfer from a variable internal heat source was developed for use with cylindrical reactor fuel element. The solution was obtained for the stationary temperature field under ideal heat flux conditions along the cylinder length. (R.V.J.)

4126
LAMINAR FLOW IN A UNIFORMLY POROUS CHANNEL. F. M. White, Jr., B. F. Barfield, and M. J. Goglia (Georgia Inst. of Tech., Atlanta). J. Appl. Mech. 25, 613-17(1958) Dec.

The problem of laminar channel flow has been investigated for the case of uniform fluid suction or injection through the channel walls. The solution can be divided into three steps: (a) A judicious choice of stream function reduces the Navier-Stokes equations to an ordinary, fourth-order, nonlinear differential equation, which contains a free parameter R, the Reynolds number based upon fluid velocity through the wall. (b) Since general analysis of this equation is intractable, the parameter R is eliminated by a suitable transformation. (c) The transformed, nonparametric equation yields to a series solution, valid and absolutely convergent for all R. From this general solution, expressions are developed for velocity components, pressure distribution, and wall-friction coefficient. (auth)

4127
HEAT TRANSFER BETWEEN COPPER AND LIQUID HELIUM II. N. J. Brow and D. V. Osborne (Univ. of St. Andrews, Fife, Scot.). Phil. Mag. 3, 1463-7(1958) Dec.

When heat flows from a solid into liquid helium II, there exists at the interface a temperature discontinuity, the magnitude of which is proportional to the heat flow density. Measurements to determine the constant of proportionality were made for copper and liquid helium II using an alternating heat flow. A description of the measuring apparatus is presented, and the results, together with the previous measurements, are shown in graphic form. (J.H.M.)

4128
HIGH TEMPERATURE WATER SYSTEMS. Owen S. Lieberg. New York, The Industrial Press, 1958. 217p.

The use of high temperature water as a medium for distributing heat is presented. The first chapter discusses the advantages of high temperature water. The next two chapters discuss thermal properties of water and design considerations of a high temperature water system. Following chapters present various component parts of the system such as: boilers, expansion tanks, pumps, valves, and piping. The design and control of a typical system is included. (W.L.H.)

4129
HEAT EXCHANGERS. Applications to Gas Turbines. W. Hryniszak. New York, Academic Press Inc., 1958. 349p.

Heat exchanger development trends are discussed. From chapters two to six the types of gas turbine heat exchangers, different ways of performing heat transfer, principal thermodynamic properties of heat exchangers, influence of the heat exchanger on the performance of the gas turbine system, and influence of the thermodynamic properties of an air preheater on its main dimensions are discussed. Other chapters discuss the design of recuperative heat exchangers, regenerators, part load performance of an air preheater, test arrangements and testing, stresses and materials, and general design problems affecting gas turbines. (W.L.H.)

Nuclear Properties and Reactions

4130 CF-58-12-26
Oak Ridge National Lab., Tenn.
COMPARISON OF BETA WITH GAMMA COUNTING FOR THE MEASUREMENT OF 2.56h NICKEL-65. C. E. Miller. Dec. 10, 1958. 10p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Nickel-65 produced by a $Ni^{64}(n,\gamma)Ni^{65}$ reaction has a 2.56-hr half life and decays by emission of a beta particle to Cu^{65}. The decay takes place by 57% 2.10-Mev beta, 29% 0.60-Mev beta, and 14% 1.0-Mev beta. These are accompanied by emission of gamma rays having energies of 1.49 Mev, 1.12 Mev, and 0.37 Mev. Nickel-65 activity can be measured by counting the beta particles, the gross gamma energies, or discrete gamma energies. (W.L.H.)

4131 CRRP-760
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
CROSS SECTIONS AND YIELDS OF PSEUDO-FISSION-PRODUCTS. D. G. Hurst, J. M. Kennedy, and W. H. Walker. Oct. 27, 1958. 17p. (AECL-715). $0.50 (AECL).

In an earlier report on the cross section of irradiated fission products, the average absorption cross section produced per fission was calculated as a function of irradiation and expressed in terms of three pseudo-fission products. To provide up-to-date values, the calculation was repeated using recent data. The cross sections calculated are listed as functions of irradiation. The fractional yields of pseudo-fission products

are given for the preferred fitting over the irradiations from 0 to 3 n/kb and from 0 to 10 n/kb. (W.D.M.)

4132 CU-177

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.

THE BETA AND GAMMA RADIATIONS OF $_{35}Br^{82}_{47}$ AND $_{37}Rb^{82}_{45}$ AND THE ENERGY LEVELS OF $_{36}Kr^{82}_{46}$. Noémie Benczer-Koller. May 29, 1958. 95p. Contract AT-30-1-GEN-72. $2.50(OTS).

Measurements of the β and γ radiations of the isotopes Br^{82} and Rb^{82} that decay to the same final even-even nucleus Kr^{82} are reported. The continuous β spectra as well as the internal conversion spectra were measured with the help of the magnetic solenoidal spectrometer. γ rays were studied with a multiple-channel scintillation detector and two "fast-slow" scintillation coincidence spectrometers, one of which was used mainly for the determination of coincidence spectra and the other for angular correlation work. The energy level diagram of Kr^{82} was established, spins and parities were assigned to all levels, and the relative intensities and multipolarities of the radiative transitions were determined. Finally, an attempt was made to compare the predictions of the two most successful nuclear models, the "shell model" and the "collective model," with the observed characteristics of Kr^{82}. (auth)

4133 CU-180

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.

FAST NEUTRON PRODUCING REACTIONS FROM N^{14} AND N^{15}. Jesse Leo Weil. Oct. 24, 1958. 82p. Contract AT-30-1-GEN-72. $2.25(OTS).

The excitation curve for the $N^{15}(p,n)O^{15}$ reaction at zero degrees has been measured from threshold at 3.78 Mev to 6.38 Mev bombarding energy. Resonances corresponding to excited states in O^{16} at 16.21, 16.3, 17.0, 17.13, 17.29, 17.5, 17.63, 17.84, 17.97, and 18.05 Mev were observed. The 16.21-Mev state is $J^{\pi} = 1^+$ and the 16.3-Mev state is $J^{\pi} = 0^-$. The energy difference between the $N^{15}(p,n)O^{15}$ threshold energy and the $Li^7(p,n)Be^7$ H_2^+ beam thick target threshold was found to be 17.6 ± 0.5 kev. A threshold energy for $N^{15}(p,n)O^{15}$ of 3.7808 ± 0.0011 Mev is implied if possible differences in the extrapolated end points of the $Li^7(p,n)Be^7$ thresholds with H^+ and H_2^+ beams are ignored. A search was made for excited states in O^{16} in the region of 11-Mev excitation using the counter-ratio method to detect slow neutron thresholds in the reaction $N^{15}(d,n)O^{16*}$. Thresholds were observed which correspond to excited states at 10.935 ± 0.010 and 11.061 ± 0.015 Mev. A review of all the present experimental information on the excited states in this region is given. Absolute cross sections for the $N^{14}(d,n)O^{15}$ and $N^{15}(d,n)O^{16}$ reactions have been measured at zero degrees to the incident deuteron beam from 0.6 to 5.3 Mev bombarding energy. Both excitation curves show strong resonance structure and have maximum cross sections of about 6 millibarns per steradian. Eight angular distributions were measured for the $N^{15}(d,n)O^{16}$ reaction at points on and off maxima in the excitation curve. A good fit to the angular distributions is obtained by use of the exchange stripping theory of Owen and Madansky. (auth)

4134 CWR-4040

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

ELASTIC AND INELASTIC NEUTRON CROSS SECTIONS. Devereux L. Kavanagh and C. E. Mandeville. June 1958. 160p. $4.25(OTS).

This is a summary report prepared from a series of detailed cross-section reports. The following sections are included: inelastic scattering of neutrons by Fe^{56} and Al^{27}; angular distribution and cross sections for Fe and Al; neutron inelastic cross section calculations for Pb^{207} and Pb^{208}; energy distributions of neutrons inelastically scattered by Pb; and neutron scattering by U^{238}. (A.C.)

4135 SC-4174(TR)

Sandia Corp., Albuquerque, N. Mex.

A MONTE CARLO CALCULATION OF THE NEUTRON FLUX FROM A MONOENERGETIC POINT SOURCE IN AIR. C. R. Mehl. Apr. 1958. 135p. Contract [AT(29-1)-789]. $19.80(ph OTS); $6.30(mf OTS).

Results of a calculation of neutron transport through air are presented. Neutron flux and angular distributions are presented as functions of energy and radial distance from the source. (auth)

4136 TNCC(UK)-34

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NOTES ON A PRELIMINARY MEASUREMENT OF THE THERMAL CROSS-SECTION OF SAMARIUM-151. S. J. Cocking. Dec. 1958. 6p.

Some information on the neutron total cross section in the thermal energy range of the abundant fission product poison Sm^{151} ($T_{1/2}$ = 80 yr) was obtained. A curve for the cross section was obtained using the preliminary data. (J.E.D.)

4137 USNRDL-TR-280

Naval Radiological Defense Lab., San Francisco.

CROSS SECTION FOR THE $Li^6(n,t)He^4$ REACTION FOR 12.5- TO 18.3-MEV NEUTRONS. B. D. Kern and W. E. Kreger. Nov. 25, 1958. 35p.

The cross section for the $Li^6(n,t)He^4$ reaction has been measured for 12.5- to 18.3-Mev neutrons. The neutrons were obtained from the $T(d,n)He^4$ reaction, and their flux density was determined by counting the recoil He^4 particles. A 1½ inch in diameter by ½ inch thick $Li^6I(Eu)$ scintillation crystal served as both the Li^6 sample and the detector for the reaction products. The cross section is nearly linear from 34.3 mb at 12.5 Mev to 17.6 mb at 18.3 Mev. It is 28.1 ± 1.6 mb at 14.2 ± 0.18 Mev. (auth)

4138 AEC-tr-3491

SOME NEW MAGIC NUMBERS FOR NUCLEONS. I. A. Vaisman. Translated for Oak Ridge National Lab. from Zhur. Eksptl'. i Teoret. Fiz. 34, 1325-7(1958). 5p.

It is very probable that certain magic properties are inherent in configurations of 30 neutrons and 42 and 62 protons or neutrons. These configurations do not coincide with the shell configurations, and it is emphasized that the nature of their stability can be completely different from that observed during the closing of the shell terms. An enumeration of the new magic numbers is presumably not limited to this. However, it would be sufficient to recognize only these three numbers in order to question the existence of some still yet unstudied properties of nuclei along with those already known. (W.D.M.)

4139 AEC-tr-3514

STUDY OF GAMMA-RAYS EMITTED BY NUCLEI OF

VANADIUM, MANGANESE, COBALT, AND ALUMINUM DURING CAPTURE OF THERMAL NEUTRONS. L. V. Groshev, A. M. Demidov, V. H. Lutsenko, and V. I. Pelekhov. Translated for Atomics International, Canoga Park, Calif. from Atomnaya Energ. 3, 187-203 (1957). 14p.

With a magnetic spectrometer analyzing Compton electrons, the energy and intensity of gamma rays emitted by nuclei which are formed during the capture of thermal neutrons by vanadium, manganese, cobalt, and aluminum were measured. Spectra of gamma rays were studied in the range from 0.25 to 11.5 Mev in the case of vanadium and from 0.25 to 8 Mev in the case of manganese, cobalt, and aluminum. Diagrams were constructed of gamma transitions in the nuclei of V^{52}, Mn^{56}, Co^{60}, and Al^{28}. Gamma rays accompanying the radioactive decay of Mn^{56} were studied. (auth)

4140

KINETIC ENERGY OF A NUCLEON IN THE STRONG COUPLING THEORY. Yu. V. Tsekhmistrenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Dodatok do Ukrain. Fiz. Zhur. 2, No. 2, 3-11(1957). (In Ukrainian)

The validity of the nonrelativistic representation of nucleon kinetic energy in the adiabatic theory of the nucleon strong coupling with a pseudoscalar meson field is considered. The rest mass of a nucleon and its kinetic energy in the strong coupling theory are frequently disregarded or written in the nonrelativistic form. In this paper the neglected terms $\beta M_0 + \alpha\,(\vec{K} + \vec{\Omega})$ are consistently taken into account. Because of the independence of the nucleon rest mass operator βM_0 of the meson field coördinates and its commutativity with the Hamiltonian of spin-charge movement (in the zero approximation for the meson field deviation from its equilibrium form), it proved possible to find the common eigenfunctions of both operators and the eigenvalues of their sum. Eight eigenfunctions and four eigenvalues of the operator of the spin-charge movement plus the nucleon rest mass were obtained. One half of all states proved to be of the nucleon type (sign before M_0 is positive); the other half, of the antinucleon type (sign before M_0 is negative). All system energy corrections of the second order were obtained from the secular equation, the first-order corrections vanishing because of the properties of the wave-functions found. If the level spacings of the slow sub-system (meson oscillations and isobaric movement) in the denominator are small compared to the fast system level spacings, the second-order correction is readily obtained.

If the operator $\dfrac{(\vec{K} + \vec{\Omega})^2}{2\left(M_0 - \frac{4}{3}G\right)}$ can be considered as a small perturbation of the slow sub-system movement, then the nonrelativistic representation of kinetic energy is valid. (tr-auth)

4141

SCATTERING AND ABSORPTION OF γ QUANTA BY NUCLEONS IN THE STRONG COUPLING THEORY. Yu. V. Tsekhmistrenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Dodatok do Ukrain. Fiz. Zhur. 2, No. 2, 59-60(1957). (In Russian)

The cross sections for non-mesonic processes involving gamma quanta (nucleon scattering and absorption) were calculated. (R.V.J.)

4142

THE REACTION $K^{40}(n_{th},p)Ar^{40}$. J. Rossel and J. Weber (Univ. of Neuchatel, Switzerland). Helv. Phys. Acta 31, 727-33(1958). (In French)

The protons emitted by a thin layer of enriched KCl under irradiation with monoenergetic neutrons of 0.054 ev were recorded in Ilford C_2 nuclear emulsions. The total neutron flux was monitored by the $N^{14}(n,p)C^{14}$ reaction observed in the same emulsion. The cross-section for K^{40} was found to be $\sigma(n,p) = (3.8 \pm 0.7) \times 10^{-24}$ cm^2 and the energy of the proton $E_p = (2.23 \pm 0.10)$ Mev in good agreement with the value deduced from the masses. Using the experimental value of $\sigma(n,p)/\sigma(n,\gamma)$, a reasonable guess for Γ_γ, and the theoretical estimate of Γ_p, it appears probable that the involved level of the compound nucleus K^{41} has spin J = 9/2 and odd parity. (auth)

4143

NUCLEAR SPIN-SPIN COUPLING BETWEEN FLUORINE AND HYDROGEN IN FLUOROBENZENE. Børge Bak (Univ. of Copenhagen); J. N. Shoolery (Varian Associates, Palo Alto, Calif.); and George A. Williams, III (Stanford Univ., Palo Alto, Calif.). J. Mol. Spectroscopy 2, 525-38(1958) Dec.

High resolution proton and fluorine nuclear magnetic resonance (nmr) spectra of fluorobenzene, 4D-, 2,4,6-D_3-, and 2,3,5,6-D_4-fluorobenzene have been obtained and analyzed. Double irradiation techniques were employed to eliminate the effects of the deuterium nuclear spin. The secular equation for 4D-fluorobenzene has been solved and the parameters adjusted for the best correspondence between the predicted and observed spectra. The nuclear spin couplings between the fluorine nucleus and the ortho, meta, and para protons are found to be, respectively, 9.4 ± 0.2 cps, 5.8 ± 0.2 cps, and 0.0 ± 0.5 cps. These couplings are found to have the same sign as the proton-proton couplings in the fluorobenzene molecule. This result is discussed and related to previous work on fluorobenzenes. (auth)

4144

CHEMICAL SHIFTS OF N^{14} IN THE NMR SPECTRA OF AMMONIA AND RELATED COMPOUNDS. Bernhard M. Schmidt, L. Carlton Brown, and Dudley Williams (Ohio State Univ., Columbus). J. Mol. Spectroscopy 2, 539-50(1958) Dec.

The nuclear magnetic resonances of N^{14} in ammonia and related compounds have been studied in a field $H_0 = 10{,}730$ gauss. Shifts of the resonances relative to the peak associated with N^{14} in the NH_4^+ ions in a saturated aqueous solution of NH_4NO_3 have been measured for the following compounds: NH_4Cl, NH_4Br, NH_4I, $NH_4H_2PO_4$, $(NH_4)_2S$, $NH_4SO_4{\cdot}ZnSO_4{\cdot}6H_2O$, NH_4SCN, ammonium hydroxide, NH_3 liquid, NH_3 dissolved in ethanol, $Ag(NH_3)_2NO_3$, $Zn(NH_3)_5Cl$, $Ca(NH_3)_8Cl_2$, $N(CH_3)_4Cl$, $N(CH_3)_4Br$, and $NH(CH_3)_2$. Mixtures of ammonium salt solutions with ammonium hydroxide have also been studied. The relative widths of the resonance peaks have been determined. Experimental details are given in the paper. The structure of ammonium hydroxide is discussed in the light of the data presented. (auth)

4145

CHEMICAL SHIFTS OF N^{14} IN THE NMR SPECTRA OF NITRATES, NITRITES, AND NITRO-COMPOUNDS. Bernhard M. Schmidt, L. Carlton Brown, and Dudley Williams (Ohio State Univ., Columbus). J. Mol. Spectroscopy 2, 551-7(1958) Dec.

The nuclear magnetic resonances of N^{14} in the nitrate groups in $LiNO_3$, $NaNO_3$, KNO_3, $AgNO_3$, $Ag(NH_3)_2NO_3$, $Zn(NO_3)_2$, $Pb(NO_3)_2$, $Cd(NO_3)_2$,

$UO_2(NO_3)_2$, and $Al(NO_3)_3$ have a zero chemical shift with respect to the N^{14} peak in the nitrate group of NH_4NO_3; the line widths of these resonances are the same. The N^{14} peak in HNO_3 is of comparable width but has a large positive shift that is concentration dependent; this observation is in agreement with earlier studies. The N^{14} peak in the paramagnetic salt $Cu(NO_3)_2$ has a large concentration-dependent positive shift. The organic compounds containing NO_2 groups showed positive shifts and line widths approximately 4 times that of the normal nitrates. The N^{14} resonance in $NaNO_2$ is 20 times the width of the normal nitrate resonance and has a large negative shift. The results are discussed. (auth)

4146

NEUTRON-PROTON INTERACTION. Yatendra Pal Varshni (Univ. of Allahabad, India). Nature 182, 1726-8 (1958) Dec. 20.

A new approach is suggested to the proton-neutron interaction and the deuteron problem. A calculation was made of the binding energy of the deuteron by the suggested interaction. It is proposed that the interaction between the nucleons is magnetic. A model based on quantum theory is considered and compared with the proposed phenomenological approach. (C.H.)

4147

BREMSSTRAHLUNG EXPERIMENTS. X-RAY PHOTONS PRODUCED BY BOMBARDING NUCLEAR TARGETS. Nuclear Energy Engr. 12, 444-6(1958) Dec.

Investigations were made of the production of x rays in thin targets as a function of various parameters such as the initial electron energy, the photon energy and emission angle, the photon polarization, and the electron recoil energy and angle. Experiments were conducted at energies of 0.05, 0.5, and 1 Mev using a constant-potential accelerator as an electron source. The x-ray spectra and angular distribution of photons were obtained with a scintillation spectrometer, consisting of a sodium iodide crystal, photomultiplier, and pulse height analyser. The general shape of the x-ray spectra and shape of the high-energy tip were observed using betatron-produced electrons with energies greater than 2 Mev. The photoexcitation of the 15.11 Mev level of carbon-12 was used to examine the high-energy end of a 15 to 20 Mev spectra. An x ray polarimeter was used to measure the photo polarization as a function of photon energy and angle at energies of 0.5 and 1 Mev. (J.H.M.)

4148

EXCITED STATES OF Cu^{64} AND Cu^{66}. R. P. De Figueiredo, M. Mazari, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 112, 873-6(1958) Nov. 1.

The $Cu^{63}(d,p)Cu^{64}$ and $Cu^{65}(d,p)Cu^{66}$ reactions were investigated through studies of the proton groups arising from the deuteron bombardment of thin targets of isotopically enriched copper. The incident deuteron beam, with energies ranging from 6.00 to 6.55 Mev, was obtained from an electrostatic accelerator, and the protons were analyzed with a high-resolution magnetic spectrograph. In the region of excitation up to 3.80 Mev, sixty-five excited states in Cu^{64} and fifty-five in Cu^{66} were measured. The Q values for the transitions to the ground states of Cu^{64} and Cu^{66} are 5.691 ± 0.008 Mev and 4.832 ± 0.008 Mev, respectively. (auth)

4149

GAMMA-RAY ABSORPTION IN CARBON. Milo M. Wolff and William E. Stephens (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 112, 890-2(1958) Nov. 1.

The total absorption in carbon of the gamma rays from the $T^3(p,\gamma)He^4$ reaction was measured as a function of proton energy and hence gamma-ray energy. As the gamma-ray energy was varied from 20.3 to 20.8 Mev, the total absorption cross section in carbon varied smoothly from 315 ± 5 to 324 ± 6 millibarns. The resolution was better than 70 kev and the sensitivity sufficient to detect narrow resonances of more than 0.8 Mev-millibarns integrated cross section, but no structure was observed although photonuclear resonances have been reported in this region. (auth)

4150

MEASUREMENTS ON THE v/c DEPENDENCE OF THE BETA-CIRCULARLY POLARIZED GAMMA CORRELATION IN Co^{60} USING A MAGNETIC-LENS SPECTROMETER. L. A. Page, B.-G. Pettersson, and T. Lindqvist (Univ. of Uppsala). Phys. Rev. 112, 893-6(1958) Nov. 1.

Measurements were made of the circular polarization of Co^{60} gamma rays in coincidence with beta rays whose momentum is defined by a magnetic lens spectrometer. The gamma rays are analyzed by a transmission-type Compton analyzer of new construction (toroidal geometry). At nominal 180° between beta and gamma, and accepting both of the gamma-ray lines, the degree of circular polarization is generally higher than the expected +0.33v/c and markedly so for the smaller speeds. Proceeding downward in v/c from 0.71 to 0.33 there is no indication that the polarization falls off as fast as would be given by a "v/c law." (auth)

4151

ANGULAR DISTRIBUTIONS OF ELASTICALLY AND INELASTICALLY SCATTERED PROTONS FROM INDIUM. R. D. Sharp and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 112, 897-902 (1958) Nov. 1.

Thin targets of natural indium were bombarded with 7.04-Mev protons, and the scattered particles were analyzed with a magnetic spectrograph. Inelastically scattered protons were observed corresponding to excited states in In^{115} at 1.078, 1.135, 1.292, and 1.982 Mev. Measurements were made on the variation of the absolute cross sections for elastic and inelastic scattering, and it is concluded that a direct interaction process is important in the excitation of these states. (auth)

4152

APPLICATION OF PERTURBATION METHODS TO THE THEORY OF NUCLEAR MATTER. D. J. Thouless (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 112, 906-22 (1958) Nov. 1.

A generalized perturbation theory is developed in such a way that it can be applied to a many-body problem with strong forces between the particles. The Brueckner expression for the energy is shown to be the first-order term in a particular case of this expansion. Some of the higher-order terms in the expansion are studied, and the importance of self-consistency in the energy denominator of Brueckner's equation and of the use of the exclusion principle in intermediate states is assessed. A possible simplification of the methods used is suggested, which involves solving the Brueckner equation for the hard core, and using normal perturbation theory for the attractive part of the potential. The methods developed are used to analyze some details of previously published calculations. The lack of equality between the Fermi energy and the binding energy in the nuclear matter calculations shows that there must be a

rearrangement energy. A simple formula for the rearrangement energy is derived, and its importance for single-particle excited states, such as occur in the optical model, is shown. The relation between the rearrangement energy and the departure of the system from a degenerate Fermi-gas state is shown. The effect of the rearrangement energy on the ground-state energy is indirect, but it is as important as the self-consistency condition. The rearrangement energy seems to come mainly from the hard core, and simple numerical estimates of the rearrangement energy from a hard core potential show that it is somewhat less than 16 Mev at the Fermi surface. The ground-state energy is reduced by perhaps 1 Mev. There seems to be a discrepancy between the calculated and observed energy dependence of the real part of the optical model potential. (auth)

4153

$Li^6(n,t)He^4$ CROSS SECTION FOR 12.5- TO 18.3-Mev NEUTRONS. Bernard D. Kern and William E. Kreger (United States Naval Radiological Defense Lab., San Francisco). Phys. Rev. 112, 926-30(1958) Nov. 1.

The cross section for the $Li^6(n,t)He^4$ reaction was measured for 12.5- to 18.3-Mev neutrons. The neutrons were obtained from the $T(d,n)He^4$ reaction and their flux density was determined by counting the recoil He^4 particles. A $Li^6I(Eu)$ scintillation crystal $1\frac{1}{2}$ inches in diameter by $\frac{1}{2}$ inch thick served as both the Li^6 sample and the detector for the reaction products. The cross section is nearly linear from 34.3 mb at 12.5 Mev to 17.6 mb at 18.3 Mev. It is 28.1 ± 1.6 mb at 14.2 ± 0.2 Mev. (auth)

4154

SEARCH FOR ELECTRIC MONOPOLE PAIRS FROM THE 7.6-Mev STATE OF C^{12}. T. H. Kruse and R. D. Bent (Columbia Univ., New York). Phys. Rev. 112, 931-2(1958) Nov. 1.

A search was made for weak 7.6-Mev electric monopole pairs from the reaction $Be^9(\alpha,n)C^{12}*$ using a thin target, 5.7-Mev alpha particles, and a scintillation pair spectrometer. No 7.6-Mev pairs were seen with an intensity as great as 1.6×10^{-5} that of 4.43-Mev gamma rays. This result gives a limit of $\Gamma_{\pm e}/\Gamma_{total} < 1.3 \times 10^{-4}$ for the ratio of the partial width for pair emission to the total width of the 7.6-Mev state. If an estimated alpha-particle width of 0.5 ev is taken for the total width of the 7.6-Mev state, then an upper limit of $\Gamma_{\pm e} < 7 \times 10^{-5}$ ev is obtained for the partial width for pair emission of the 7.6-Mev state. (auth)

4155

RADIO-FREQUENCY ORIENTATION OF Sb^{122}. Francis M. Pipkin (Harvard Univ., Cambridge, Mass.). Phys. Rev. 112, 935-44(1958) Nov. 1.

Radioactive Sb^{122} donors in a doped silicon crystal were oriented by saturation of forbidden transitions and by the Overhauser method. Double-resonance experiments in which an electron and a nuclear transition were saturated simultaneously were used to determine the Sb^{122} hyperfine splitting. A short discussion is given of how the nuclear relaxation mechanisms affect the double-resonance orientation signals. The hyperfine splitting of Sb^{122} was found to be −132.59 ± 0.10 Mc/sec and its spin 2. The gyromagnetic ratio is −0.952 ± 0.010. (auth)

4156

SHAPE OF THE Pr^{143} BETA SPECTRUM. J. H. Hamilton, L. M. Langer, R. L. Robinson, and W. G. Smith (Indiana Univ., Bloomington). Phys. Rev. 112, 945-50(1958) Nov. 1.

Small deviations from the statistical shape previously reported for Pr^{143} might be expected from a theoretical prediction for such a once-forbidden nonunique transition. The spectrum was investigated with greater precision and in greater detail than in past studies, with magnetic and scintillation spectrometers. The spectrum is found to exhibit small deviations from a statistical shape. The spectrum can be fitted with a once-forbidden, nonunique shape factor. (auth)

4157

RADIATIONS OF Xe^{127}. R. N. Forrest and H. T. Easterday (Univ. of Oregon, Eugene). Phys. Rev. 112, 950-4(1958) Nov. 1.

The radiations of Xe^{127} were examined. The energies of previously observed gamma rays were found to be 58 ± 1, 146 ± 0.5, 173.0 ± 0.5, 204.5 ± 0.5, and 377.5 ± 0.5 kev. Conversion electron intensities relative to gamma-ray intensities and internal conversion coefficients were measured. The experiment indicates that electron capture to the ground state is suppressed. Spin and parity assignments are proposed for the 204- and 377-kev excited states of I^{127}. (auth)

4158

STRUCTURE OF THE NUCLEAR MASS SURFACE. George A. Baker, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 112, 954-9(1958) Nov. 1.

The nuclear mass surface is analyzed in terms of its observed structural properties, and a formula is developed for the binding energy which is easy to use and is accurate, over all, to ±0.54 Mev, and, for A > 214, to ±0.27 Mev. (auth)

4159

DELAYED NEUTRONS FROM THE SPONTANEOUS FISSION OF Cf^{252}. S. Cox, P. Fields, A. Friedman, R. Sjoblom, and A. Smith (Argonne National Lab., Lemont, Ill.). Phys. Rev. 112, 960-3(1958) Nov. 1.

The periods and absolute yields of delayed neutrons emitted following the spontaneous fission of Cf^{252} were measured. Delayed-neutron periods of $\tau_{\frac{1}{2}} = 0.5 \pm 0.4$, 2.0 ± 0.4, and 20.0 ± 0.5 sec with respective absolute yields of 0.35, 0.29, and 0.22% were found. The experimental results are correlated with delayed-neutron emission from other fission processes and with existing precursor systematics. (auth)

4160

SEARCH FOR ELECTRIC MONOPOLE PAIRS FROM THE 3.82-Mev STATE OF Ca^{48}. K. E. Eklund and R. D. Bent (Columbia Univ., New York). Phys. Rev. 112, 966-7(1958) Nov. 1.

A search was made for 3.82-Mev electric monopole pairs from the reaction $Ca^{48}(p,p')Ca^{48}*$ using a $CaCO_3$ (35% Ca^{40}, 62% Ca^{48}) target, 6.0-Mev protons, and an intermediate-image spectrometer. No 3.82-Mev pairs from Ca^{48} were observed with an intensity as great as 0.3% that of the 3.35-Mev electric monopole pairs from Ca^{40}. This result suggests that the 3.82-Mev state of Ca^{48} decays predominantly by gamma emission. This could occur if the 3.82-Mev state has spin >0, or if there are lower excited states in Ca^{48}. (auth)

4161

NEUTRON EMISSION FOLLOWING μ-MESON CAPTURE IN SILVER AND LEAD. Selig N. Kaplan, Burton J. Moyer, and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. 112, 968-78(1958) Nov. 1.

The neutron yield from the capture of cosmic-ray μ^- mesons in silver and lead was measured with a high-efficiency Cd-loaded liquid-scintillator tank. The aver-

age multiplicities were determined to be $\bar{\nu}_{Ag} = 1.60 \pm 0.18$ and $\bar{\nu}_{Pb} = 1.64 \pm 0.16$. The multiplicity distributions were also measured and compared with several theoretical models. Although an α-particle model gave results not inconsistent with the data, a Fermi-gas model with the effective nucleon mass M* set equal to M/2 seemed to provide the better fit. (auth)

4162

PHOTOPRODUCTION OF K^+ MESONS IN HYDROGEN. P. L. Donoho and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. 112, 981-6(1958) Nov. 1.

K^+ mesons produced in a liquid hydrogen target bombarded by the 1100-Mev bremsstrahlung of the California Institute of Technology synchrotron were observed. It was found that the K^+ mesons are produced in association with Λ^0 hyperons, in accordance with the law of associated production of strange particles. The K^+ mesons were momentum-analyzed in a magnetic spectrometer and identified by their energy loss in three scintillation counters, the very large background due to pions and protons being virtually eliminated by means of time-of-flight discrimination. The differential cross section for the reaction $\gamma + p \rightarrow K^+ + \Lambda^0$ was measured at photon energies of 960, 1000, and 1060 Mev at various K^+-meson laboratory angles between 15 and 45 degrees. This cross section shows little variation with photon energy between 960 and 1060 Mev or with center-of-momentum angle over the range investigated. (auth)

4163

MEASUREMENT OF THE RANGE OF RECOIL ATOMS. Roman A. Schmitt and Rodman A. Sharp (General Atomic, San Diego, Calif.). Phys. Rev. Letters 1, 445-7(1958) Dec. 15.

A novel experimental technique has been applied to the problem of determining the ranges of atoms in the Kev region. The method used was similar to the stacked-foil technique commonly used in charged-particle excitation-function studies. Ranges were determined for carbon (in polystyrene, CH), F (in Teflon, CF_2), Cl(in Saran, CHCl), and the metals Ti, Fe, Zn, Cu, Mo, Ag, and Au, in their respective metallic lattices. (T.B.A.)

4164

Li^7 AND F^{19} NUCLEAR MAGNETIC RESONANCES IN NEUTRON-IRRADIATED LiF. P. J. Ring, J. G. O'Keefe, and P. J. Bray (Brown Univ., Providence). Phys. Rev. Letters 1, 453-4(1958) Dec. 15.

Nuclear magnetic resonance examinations of LiF samples subjected to neutron dosages of the order of 10^{18} nvt have revealed the presence of constituent nuclei in environments other than those of the normal lattice sites. The nuclei produce narrow lines which are superimposed on the normal broad lines. The narrow Li^7 and F^{19} lines may be due to colloidal lithium metal and molecular fluorine gas. (T.B.A.)

4165

RELATIVISTIC CORRECTIONS TO THE FERMI MATRIX ELEMENT. A. Altman and W. M. MacDonald (Univ. of Maryland, College Park). Phys. Rev. Letters 1, 456-7 (1958) Dec. 15.

The uncertainty in the variations of the ft values in the scheme $J = 0^+ \rightarrow J = 0^+$ produced by the energy-dependent relativistic terms of the scalar nuclear matrix elements is shown to be insufficient to mask the presence of a Fierz term larger than the limit set by Gerhart. The calculation of the matrix element is made in the shell model with harmonic wave functions. From this, the ratio of ft values for O^{14} and C^{34} positron decay is determined. To check whether the result is sensitive to the shape of the potential, the calculation is repeated using the Dirac wave function for a particle in a finite square well. The comparison of the ratios shows that the effect of the relativistic corrections to the ratio of the ft values is uncertain in the exact values; the magnitude is a fraction of one per cent. (T.B.A.)

4166

STRENGTH FUNCTIONS FOR DEFORMED NUCLEI. D. J. Hughes, R. L. Zimmerman, and R. E. Chrien (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 1, 461-3(1958) Dec. 15.

Results are reported of the neutron strength function measurements made with the Brookhaven fast chopper on deformed nuclei. (T.B.A.)

4167

NUCLEAR GROUND-STATE SPINS OF THALLIUM-198 AND -201. I. Lindgren, C. M. Johansson, and S. Axensten (Univ. of Uppsala). Phys. Rev. Letters 1, 473-4 (1958) Dec. 15.

Nuclear ground-state spins of Tl^{198} and Tl^{201} have been measured by the atomic beam resonance method. Values obtained are: for the 5.3-hr Tl^{198}, I = 2, and for the 3.0-day Tl^{201}, $I = \frac{1}{2}$. (T.B.A.)

4168

ELECTRON-NEUTRINO ANGULAR CORRELATION IN THE BETA DECAY OF NEON-23. R. L. Burman, W. B. Hermannsfeldt, and J. S. Allen (Univ. of Illinois, Urbana) and T. H. Braid (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 2, 9-11(1959) Jan. 1.

A study was made of the angular correlation coefficient in the decay of Ne^{23}. The experimental result, $\lambda = -0.37 \pm 0.04$, indicates that the axial-vector interaction is dominant in the Gamow-Teller type of decay. (J.H.M.)

4169

BETA RADIATION EMITTED BY THALLIUM-204. Fernand Grard. Physica 24, 868-74(1958) Nov. (In French)

The beta spectra of Tl^{204} was examined with a double focusing spectrometer. It has a forbidden form of the first order, "unique," corresponding to $\Delta J = 2$, yes. The Fermi track is linear beyond 550 kev, the energy at which the measurements were made with sufficient precision. The maximum energy is 760 ± 10 kev. The deviations from theory are interpreted as the result of perturbations in the beta spectrographic measurements. (tr-auth)

4170

LIFETIME OF THE 241 kev STATE OF ^{220}Tn. J. G. Siekman and G. T. Pott (Rijks-Universiteit, Groningen, Netherlands). Physica 24, 910-12(1958) Nov.

The lifetime of the 241-kev state of Rn^{220} was measured by a delayed fast coincidence technique, using the alphas feeding the level and the 142.1-kev K conversion electrons deexciting it. An experimental lifetime of $\tau_{exp} = (4.5 \pm 1.6) \times 10^{-10}$ sec was found, both from the centroid shift of the ThX curve relative to the Co^{60} curve and from a Newton analysis. With $\alpha_{tot} = 0.3$, a reduced transition probability $B = (0.9 \pm 0.3)\ xe^2 \times 10^{-48}$ cm^6 and an intrinsic quadrupole moment $Q_0 = (3.0 \pm 0.6) \times 10^{-24}$ cm^2 was found for Rn^{220}. (J.S.R.)

4171

ON THE ELECTRON CAPTURE TO POSITRON EMISSION RATIOS IN THE DECAYS OF ^{58}Co AND ^{84}Rb.

J. Konijn, H. L. Hagedoorn, H. van Krugten, and J. Slobben (Technische Hogeschool, Delft, Netherlands). Physica 24, 931-3(1958) Nov.

The electron capture to positron emission ratios in the decay of Co^{58} and Rb^{84} were measured, and values of 5.67 ± 0.14 and 5.72 ± 0.12, respectively, were found. (J.S.R.)

4172

ELASTIC SCATTERING OF SLOW IONS IN THEIR PARENT GASES. M. R. C. McDowell (Royal Holloway Coll., Englefield Green, Surrey, Eng.). Proc. Phys. Soc. (London) 72, 1087-96(1958) Dec. 1.

Total elastic scattering cross sections for H^+, H^-, He^+, Ne^+, and Ar^+ in their parent gases are calculated for energies between 0.1 ev and 10 kev, by an impact parameter method. The Massey—Mohr approximation is used for the phase shifts. The cross sections vary as the square of the logarithm of the energy above 100 ev, but at some energy between this and 0.1 ev change to an inverse one-third power dependence. Approximate interaction energies for Ne_2^+ and Ar_2^+ at large R are obtained from charge transfer data. (auth)

4173

THE ENERGY LEVELS OF ^{31}P. I: γ-RAY SPECTRA AND DECAY SCHEMES. C. Broude, L. L. Green, and J. C. Willmott (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 1097-1114(1958) Dec. 1.

Gamma-ray spectra were studied at ten resonances in the reaction $Si^{30}(p,\gamma)P^{31}$ and decay schemes found by analysis of the spectra and coincidence experiments. (auth)

4174

THE ENERGY LEVELS OF ^{31}P. II: ANGULAR DISTRIBUTIONS AND CORRELATIONS. C. Broude, L. L. Green, and J. C. Willmott (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 1115-21(1958) Dec. 1.

Angular distributions and triple correlations have been measured at the resonances in the reaction $Si^{30}(p,\gamma)P^{31}$ discussed in Part I and spin and parity assignments made for levels in P^{31}. (See also Proc. Phys. Soc. (London) 72, 1097-1114(1958) Dec. 1.) (auth)

4175

THE ENERGY LEVELS OF ^{31}P. III: COMPARISON WITH THE NILSSON MODEL. C. Broude, L. L. Green, and J. C. Willmott (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 1122-9(1958) Dec. 1.

The spins and parities and decay properties of P^{31} determined in Parts I and II are compared with the predictions of the Nilsson model. It is found that the energies, spins, and parities of the lower levels are well accounted for but not their decay properties. (See also Proc. Phys. Soc. (London) 72, 1115-21(1958) Dec. 1.) (auth)

4176

DOUBLE SCATTERING EXPERIMENTS WITH 970 Mev PROTONS. C. J. Batty and S. J. Goldsack (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 72, 1130-6(1958) Dec. 1.

Nuclear emulsions were used as detectors to measure the asymmetries produced in a double scattering experiment using 970 Mev protons. Targets of beryllium and carbon have been used and angles between 3 and 8° investigated. Small but significant asymmetries were found and the experiments are compared with others in this energy region. (auth)

4177

NONCONSERVATION OF PARITY AND β DECAY. G. R. Khtsishvili and S. G. Matsnyan. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 227-34(1957). (In Russian)

Polarization effects in allowed β transitions $\Delta I = 0$ were calculated by the Born approximation, therefore, the results can be applied only to the lightest nuclei. However, the correlated experimental data hold true and indicate applicability in determining all β-interaction constants. (R.V.J.)

4178

STRIPPING IN LIGHT NUCLEI INTERACTIONS. T. G. Gachechiladze. Trudy Inst. Fiz. Akad. Nauk Georgian S.S.R. 5, 235-70(1957). (In Russian)

A modified Born approximation is used in theoretical studies of heavy particle stripping in direct nuclear reactions. Angular distributions in nuclear reactions $Be^9(\alpha,n)C^{12}$ and $Be^{11}(d,n)C^{12}$ are investigated. (R.V.J.)

4179

THE NUCLEAR QUADRUPOLE MOMENT OF Mn^{55}. Hans R. Rottmann (Univ. of Heidelberg, Ger.). Z. Physik 153, 158-63(1958). (In German)

The hyperfine structure of the Mn I spectrum was investigated in the 2800 to 5500 A range with a Fabry-Perot interferometer. The quadrupole coupling constant of eight terms was determined. The nuclear quadrupole moment was $(0.3 \pm 0.1) \times 10^{-24}$ cm^2. (tr-auth)

4180

ELECTRON POLARIZATION IN THE β DECAY OF RaE. Wolfgang Buhring and Joachim Heintze (Univ. of Heidelberg, Ger.). Z. Physik 153, 237-46(1958). (In German)

The electron polarization P of Bi^{210}, with combined multiple and single scattering, was measured by comparison with Tl^{204} and Y^{91}. The results are discussed with respect to the beta spectrum of Bi^{210}. With suitable values of two parameters, which are given essentially by the ratios of the nuclear matrix elements, it is possible to clarify polarization and the spectrum theoretically. (tr-auth)

4181

NUCLEAR BOND ENERGY IN THE REGION OF THE 82 PROTON AND 126 NEUTRON MAGIC NUMBERS. R. A. Demirkhanov, T. I. Gutkin, and V. V. Dorokhov. Zhur. Eksptl'. i Teoret. Fiz. 35, 917-25(1958) Oct. (In Russian)

Measurements of masses of the isotopes of bismuth, lead, thallium, and mercury performed on a mass spectrograph of resolving power of 60,000 to 80,000 are presented. The masses of these isotopes were determined by direct comparison with the masses of the corresponding organic compounds. The masses of Pb^{206}, Pb^{207}, and Pb^{208} isotopes obtained from various doublets are internally consistent. The bond energy of the nuclei computed from the measured masses of the isotopes confirms the shell structure of the nucleus with a filled shell of 82 protons and 126 neutrons. The difference of the nuclear bond energy for an even and odd number of nucleons in the nucleus and its smoothing out as the shell is filled up can distinctly be seen. After the shell is filled up with Z = 82 and N = 126 the bond energy of the following neutron is greater than the bond energy of the next proton. The energy of two bound neutrons (which yields the Hg^{204} nucleus) is greater than the energy of attachment of two protons in the Pb^{204} nucleus. (tr-auth)

4182

POSITRON SPECTRUM OF $Eu^{152,154}$. D. L. Kaminskii

and M. G. Kaganskii (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 926-31(1958) Oct. (In Russian)

The spectrum of positrons emitted in the decay of $Eu^{152,154}$ were measured. The spectrum mainly consists of positrons due to pair conversion of 1410 kev γ quanta and of a β^+ spectrum with an end point energy of E_0 = 700 ± 20 kev. The spectrum is identified as that due to positron decay of Eu^{152} ($T_{1/2}$ = 13 years), its intensity being 1.2×10^{-4} positrons per decay. For this transition log (τf) is 12.1. (tr-auth)

4183

TYPES OF INTERACTION IN β-DECAY. N. A. Burgov and Yu. V. Terekhov. Zhur. Eksptl'. i Teoret. Fiz. 35, 932-9(1958) Oct. (In Russian)

Electron-neutrino correlation in the β-decay of Na^{24} was investigated by the method of nuclear resonance scattering of Mg^{24} γ-rays accompanying the β-decay of Na^{24}. A gaseous Na^{24} source was employed. The most probable value of the correlation constant was found to be $\lambda = -0.23 \pm 0.19$. The results of the investigation indicate that the only possible type of interaction involved in the β-transition of Na^{24} is axial-vector interaction which corresponds to $\lambda = -1/3$. (tr-auth)

4184

ON DETERMINATION OF THE MATRIX FOR THE REACTION a + a' → b + b'. S. M. Bilenkii, L. I. Lapidus, et al. (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 959-61(1958) Oct. (In Russian)

The conditions for determination of the matrix of the reaction a + a' → b + b' from the experimental data are considered. The number of complex scalar functions defining the reaction matrix M is determined with aid of the conditions of invariance with respect to space rotations and reflections. Time reversal invariance of the interaction leads to relations between polarization effects in the direct and inverse reactions. The number of experiments required for complete determination of the reaction matrix is indicated. (tr-auth)

4185

ON THE MECHANISM OF STRIPPING IN REACTIONS INVOLVING THE CAPTURE OF TWO NUCLEONS. V. V. Komarov, V. G. Neudachin, et al. (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 974-7(1958) Oct. (In Russian)

Reactions of the (n, t) type are examined qualitatively. Two competing processes are discussed: the process of "successive stripping" (n-d-t) and the process of simultaneous capture of two nucleons. (tr-auth)

4186

ON THE HYDRODYNAMICAL THEORY OF MULTIPLE PRODUCTION OF PARTICLES. G. A. Milekhin (Lebedev Physics Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 978-81(1958) Oct. (In Russian)

The problem of symmetry in the angular and energy distribution of secondary particle produced in collisions between a nucleon and nucleus or between two nuclei is considered on the basis of the hydrodynamical theory of multiple production of particles. It is shown that symmetry of this type exists in a special coordinate system which is close to the cms. (tr-auth)

4187

ON THE AXIALLY ASYMMETRIC NUCLEI. B. T. Geilikman (Moscow State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 989-91(1958) Oct. (In Russian)

The possibility of existence of nuclei lacking axial symmetry is proved for the generalized model. (tr-auth)

4188

INELASTIC SCATTERING OF DEUTERONS ON THE Mg^{24} NUCLEUS. T. I. Kopaleishvili and V. I. Mamasakhlisov (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 1017-19(1958) Oct. (In Russian)

The angular distribution of inelastically scattered deuterons on the Mg^{24} nucleus accompanied by excitation of the 2^+ (4.23 Mev) level due to excitation of a deformation quantum is investigated. Nuclear as well as electric interaction of the deuteron with the nucleus is taken into account. A comparison of the theory with the experimental data is carried out. (tr-auth)

4189

BINDING ENERGY OF LIGHT HYPERNUCLEI ACCORDING TO THE MESON THEORY. V. A. Lulka and V. A. Filimonov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1026-30(1958) Oct. (In Russian)

The binding energy of Λ particles in the hypernuclei H^3_Λ, H^4_Λ, He^4_Λ, and He^5_Λ was computed in the second and fourth order of perturbation theory. The results of the theoretical calculations are in satisfactory agreement with the experimental data. (tr-auth)

4190

DETERMINATION OF IMPULSE AND EXCITATION ENERGY IN HEAVY NUCLEUS EXCITATION INDUCED BY FAST PROTONS. A. I. Obukhov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 1042-4(1958) Oct. (In Russian)

The mean magnitude was experimentally determined for the longitudinal and perpendicular component of nuclear oscillation in the interaction of 660-Mev protons with uranium nuclei. Experiments were made with photographic emulsions and it was assumed, in the first approximation, that the angular distribution of fission fragments in the fissioned nuclei is isotropic. (R.V.J.)

4191

COULOMB EXCITATION OF ALUMINUM. D. G. Alkhazov, A. P. Grinberg, et al. (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1055-6(1958) Oct. (In Russian)

The Coulomb excitation of Al^{27} nuclei was studied with the aid of heavy ions accelerated in a cyclotron (15.9 Mev N^{3+} and 18.1 Mev O^{3-}). The γ radiation emitted by aluminum during the bombardment was studied with a scintillation γ spectrometer with a NaI(Tl) crystal. Two lines E = 0.84 and 1.01 Mev were observed in aluminum Coulomb excitation by nitrogen ions. The magnitudes B(E2) ↑ for the levels ΔE = 0.84 and 1.01 Mev are 0.0019 and 0.0031 $e^2 \times 10^{-48}$ cm^4 respectively; the life time for Al^{27} τ(E2) level with ΔE = 1.01 Mev is 1.7×10^{-11} sec. and for ΔE = 0.84 Mev it is 3.7×10^{-11} sec. (R.V.J.)

4192

THE LIFETIME OF THE Mg^{24} FIRST EXCITATION LEVEL. D. G. Alkhazov, A. P. Grinberg, et al. (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1056-8(1958) Oct. (In Russian)

Studies of Coulomb excitations of the Mg^{24} first level; with 15.9 Mev N^{3+}, 18.1 Mev O^{3-}, and 25.6 and 36 Mev N^{4+} ions; were complicated by the appearance of a parasite line of 1.37 Mev. The hypothetical peak of the parasite line is indicated on the γ spectrum of the natural magnesium bombardment by 15.9 Mev nitrogen ions.

The mean B(E2) ↑, determined by six different experiments, is 0.054 $e^2 \cdot 10^{-48}$ cm^4, hence, the $\tau = (1.5 \pm 0.4) \times 10^{-12}$ sec. which is close to the value $\tau = (1.7 \pm 0.4) \times 10^{-12}$ sec. reported by other authors. (R.V.J.)

4193

MEASUREMENTS OF NEUTRON HALF LIFE. A. N. Sosnovskii and P. E. Spivak. Zhur. Eksptl'. i Teoret. Fiz. 35, 1059-61(1958) Oct. (In Russian)

Results of neutron half-life measurements showed T = 11.7 ± 0.3 min, which in turn leads to the neutron ft value as 1180 ± 35. Using the relation between the magnitude ft and the ratio of constants g_{GT} and g, and comparing the neutron ft magnitude to the O^{14} (ft = 3100 J. B. Gerhart, Phys. Rev. 109, 897(1958)) the value $(g_{GT}/g_F)^2 = 1.42 \pm 0.08$. (R.V.J.)

4194

POLARIZATION OF RaE ELECTRONS AND TRANSIENT PARITY. A. I. Alikhanov, G. P. Eliseev, and V. A. Lyubimov. Zhur. Eksptl'. i Teoret. Fiz. 35, 1061-2(1958) Oct. (In Russian)

The longitudinal polarization of electrons was measured at mean energies E = 125 and 390 kev. The thickness of the 5-c Ra(D + E) source was 0.8 mg/cm^2. With $\bar{E}$ = 125 and 390 kev, the $\langle\sigma\rangle c/v = 0.733 \pm 0.06$ and 0.725 ± 0.06 respectively. (R.V.J.)

4195

ON d + d REACTIONS. I. Sh. Vashakidze and O. D. Cheishvilli (Tbiliss State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 1062-3(1958) Oct. (In Russian)

The reactions (d + d) at 675 Mev were used for the verification of D. I. Blokhintsev' (JETP 33, 1295, 1957) explanation of "over barrier" fragments in nuclear spallation by high energy nucleons. The reactions followed the schemes: (1) d + d, (2) d + n + p, (3) 2n + 2p, (4) He^3 + n, (5) He^3 + p, (6) $He^4 + \gamma$. The ratio for the three first reactions $\sigma_1/\sigma_3 \approx 5 \times 10^{-5}$, $\sigma_2/\sigma_3 \approx 1.4 \times 10^{-2}$. The other reactions obviously are specified by all indirect interactions. (R.V.J.)

4196

THE REACTION Mg^{24} (d,p) Mg^{25} AT E_d = 1.082 Mev. H. Risti and T. Grotdal. Bergen, A. S. John Griegs Boktrykkeri, 1958. 7p.

Energies and angular distributions were measured of some of the proton groups emitted from a 35 $\mu g/cm^2$ Mg^{24} target bombarded with 1.082 Mev deuterons. The proton angular distributions have been compared, when possible, with those calculated from the stripping theories enabling assignments of spins and parities to be made to the levels of the residual nucleus. A spin and parity assignment of 3/2 or 5/2, even parity, was made for the 3.899 Mev level in Mg^{25}. The relative yield of the different groups was also found. (auth)

4197

NUCLEAR MASSES AND THEIR DETERMINATION. Proceedings of the Conference held in the "Max-Planck-Institut für Chemie" Mainz, 10-12 July 1956. H. Hintenberger, ed. New York, Pergamon Press, 1957. 271p.

The present status of the determination of nuclear masses is described. Chapters two and three discuss atomic masses and nuclear structure and mass-spectroscopic results of the determination of atomic masses. The next three chapters describe the determination of nuclear masses from nuclear reactions, comparison between nuclear masses from values and mass-spectroscopic doublets, and atomic masses from microwave spectra. The next chapter describes the instruments used in the determination of nuclear masses. (W.L.H.)

Theory

4198 UCRL-Trans-373

THE ELECTRON MASS IN QUANTUM ELECTRODYNAMICS. L. D. Landau, A. A. Abrikosov, and I. M. Khalatnikov. Translated for Univ. of Calif. Radiation Lab. from Doklady Akad. Nauk S.S.S.R. 96, 261-4(1954). 10p.

4199

COPENHAGEN INTERPRETATION OF QUANTUM THEORY. Norwood Russell Hanson (Indiana Univ., Bloomington). Am. J. Phys. 27, 1-15(1959) Jan.

The theoretical and experimental context within which the "Copenhagen Interpretation" of quantum theory was generated is underemphasized by recent critics of the Bohr-Heisenberg philosophy. When an interpretation of a theory has been as successful as this one has been, there is little practical warrant for the "alternative interpretations" which have, since Bohm, been receiving prominence. Indeed, these are not even genuine alternatives; although rich in provocative prose, they provide not a scrap of algebra with which to organize the practical physicist's thinking. Several objections to the Bohr interpretation are critically examined, as is also a particular use of the correspondence principle which has seemed to cast doubt on the Copenhagen ideas. (auth)

4200

ON THE FORMATION OF QUANTUM-MECHANICAL OPERATORS. John Robert Shewell (Rice Inst., Houston, Texas). Am. J. Phys. 27, 16-21(1959) Jan.

A number of rules for forming operators corresponding to classical quantities are investigated. Spin and relativistic effects are excluded from consideration. The two rules which are in agreement with the customary interpretation of quantum mechanics are ambiguous in that they do not yield unique operators. The other rules considered yield unique operators but are in disagreement with the customary interpretation of quantum mechanics. It is shown that any symmetrization rule is in this category. All the rules investigated are linear, but no attempt is made to formulate a nonlinear rule. It is indicated that additional experimental evidence is necessary to clarify the question of quantum-mechanical operators. (auth)

4201

ELECTROMAGNETIC EQUATIONS WRITTEN IN A FORM INDEPENDENT OF THE SYSTEM OF UNITS. Dwight W. Berreman (Univ. of Oregon, Eugene). Am. J. Phys. 27, 44-6(1959) Jan.

This paper illustrates a form for writing electromagnetic equations such that by substituting the appropriate value for each of two arbitrary constants one immediately obtains the electromagnetic equations written in any of the consistent systems of units. One constant is a dimensionless term called a rationalizing factor that takes the value 4π in unrationalized systems and unity in rationalized systems. The other is ϵ_0, the capacitivity of free space. Except for the rationalizing factor, all equations are identical in appearance with equations written in the rationalized MKSQ system of units. Maxwell's equations and some other commonly used relations are presented in this form. A simple

method of obtaining the equations in the Gaussian and the Heaviside-Lorentz mixed systems of units from the form presented for consistent systems is also given. (auth)

4202
THE CENTRAL AXIS IN RELATIVISTIC HYDRODYNAMICS OF FLUID MASSES IN ROTATION. Maurice Kléman. Compt. rend. 247, 1718-20(1958) Nov. 17. (In French)

The existence of a space-time axis possessing remarkable properties is established for relativistic fluid masses in rotation. There is a generalization of the central axis of the system of velocities of classical mechanics. (tr-auth)

4203
ON THE THEORY OF THE PRODUCTION OF MANY ELEMENTARY EXCITATIONS. V. T. Khozyainov (Inst. of Biophysics, Academy of Sciences, USSR). Doklady Akad. Nauk SSR 122, 1003-6(1958) Oct. 1. (In Russian)

At temperatures different from zero, the quantum fluid (superfluid helium) is a composition of elementary excitations producing in the first approximation a quasiparticle gas (phonons and rotons), whereupon absorption and emission excitation processes are possible (phenomena of transmission and relaxation). Production of elementary excitations takes place in cases where a certain portion of energy is segregated or concentrated in some effective volume of the quantum fluid. With sufficiently high energies the produced excitation may be of multiple character. The interaction properties leading to production of excitations are unknown (though at high energy the interaction must be quite vigorous). An attempt was made to calculate the yield of the multiple process using the Fermi statistical method based on the assumption of equal excitations for all possible finite states. Moreover, the yield is related to the number of states involved in the yield (i.e., connected with its statistical weight). (R.V.J.)

4204
THEORY OF THE SCATTERING OPERATOR. II. MULTICHANNEL SCATTERING. J. M. Jauch (CERN, Geneva). Helv. Phys. Acta 31, 661-84(1958).

The mathematical theory of the scattering operator is developed for the general scattering systems involving an arbitrary number of channels. It includes as a special case the theory for 'simple scattering systems.' The scattering system is defined as a quantum mechanical system which satisfies certain asymptotic and completeness conditions. The existence of the S-operator as well as its unitary property is then a rigorous mathematical consequence of this property. A crucial step in these deductions is the orthogonality theorem for the left projections of the wave operators. The various ways of introducing the 'in' and 'out' operators and their relation to the S-operator are discussed. (auth)

4205
STUDY OF THE ONE DIMENSIONAL BOLTZMANN EQUATION. THE ENERGY LOSS BY ELASTIC COLLISION BEING NEGLECTED. P. Lafore and J. P. Millot. Inds. atomiques 2, No. 9-10, 63-8(1958). (In French)

A solution for the Boltzmann equation is given for the case where the flux per element of solid angle depends only on the variable of x space and on the angle with the privileged direction Oh. The energy loss by elastic collision is neglected, and all other collisions are considered as absorption. The case where the elastic collisions can be considered as isotropic in the laboratory system is studied in the first approximation, and the results are extended to the case where $f(\mu,\mu')$ is a polynomial of n degree in μ. (tr-auth)

4206
ELECTRON SELF-ENERGY APPROACH TO CORRELATION IN A DEGENERATE ELECTRON GAS. John J. Quinn and Richard A. Ferrell (Univ. of Maryland, College Park). Phys. Rev. 112, 812-27(1958) Nov. 1.

A new method of computing the correlation energy of a degenerate electron gas is presented in which the interactions are studied by considering the self-energy of a lone particle impurity in the system. The self-energy results as in quantum electrodynamics from the action of the proper field set up by the charged particle back on itself; the Feynman space-time formulation of quantum mechanics is employed in the self-energy calculation, which is carried out along lines already laid out by Lindhard. The Feynman propagator, which takes the particle from one point in space-time to another, is derived. A slight but essential change in the particle propagator is needed to allow for exchange effects when the particle impurity is an additional electron in the degenerate electron gas. This gives the electron gas a dual role: it acts as a dielectric medium which can be polarized and also as a vacuum from which electron-hole pairs can be created and undergo exchange with incident electrons. The polarization propagator for the effective potential set up by the impurity in the electron gas, considered as a dielectric medium, is derived heuristically from Lindhard's dynamic dielectric constant and more rigorously from the momentum-exciton model. The electron self-energy is a Feynman integral involving the particle and polarization propagators and defines an optical potential which is found to have both real and imaginary parts. For momenta less than the Fermi momentum, it is shown that the optical potential is simply the negative of the self-energy of a hole in the Fermi sea. The imaginary part of the optical potential for an electron of momentum p is proportional to $(p/p_0 - 1)^2$ (where p_0 is the Fermi momentum), and gives rise to damping. Thus the concept of a one-electron state is only valid for small excitation energies and breaks down when the electron is appreciably far removed from the Fermi surface. The mean free path for high electron density is given (in units of $\hbar/p_0$) by $3.98r_s^{-1/2}$ times the above function of momentum. (r_s is the unit-sphere radius in Bohr radii.) The derivative of the real part of the optical potential with respect to momentum, evaluated at the Fermi surface, gives a correction to the specific heat in agreement with Gell-Mann. The value of the optical potential itself is related by Seitz's theorem to the derivative of the correlation energy with respect to density. Integration over density yields an expression for the ground state energy which agrees with the results of other investigators. Finally a brief discussion is given of Bethe's theorem, which directly relates the optical potential to the ground state correlation energy per particle. Although Bethe's theorem is not valid for the idealized electron gas with uniform positive background, it does apply to actual metals in equilibrium. (auth)

4207
PERTURBATION THEORY FOR AN INFINITE MEDIUM OF FERMIONS. Abraham Klein and Richard Prange

(Univ. of Pennsylvania, Philadelphia). Phys. Rev. 112, 994-1007(1958) Nov. 1.

The ground-state energy and low-energy excitations of single-particle character of an infinite medium of fermions are discussed with the aid of time-dependent Green's functions, which are convenient generalizations of the exact particle correlation functions in the ground state of N particles. The power series development for the one- and two-particle functions, under the restriction to two-body forces, is derived and described by means of Feynman diagrams. The derivation of the linked-cluster expansion for the energy then follows immediately. The equivalence to previous versions is established. The one-particle function is examined in particular detail, and it is shown that the poles of its space-time Fourier transform studied as a function of the energy variable, for fixed momentum, determined the (N + 1)-particle and (N − 1)-particle excited states which have single-particle character. For a reasonable assumption about the full spectrum of excited states, it is found that for the interacting system, single-particle excitations with a real energy occur only at the Fermi momentum. It is pointed out that the corresponding energy, termed the perturbed Fermi energy, equals the binding energy per particle in the ground state of N particles for a saturating system at equilibrium density. It is shown, finally, that the entire structure of the theory may be carried over to the case of finite temperature, requiring only a redefinition of the Green's functions. The analogy is constructed from a discussion of the internal energy. (auth)

4208

EXCHANGE SCATTERING IN SUPERCONDUCTORS. H. Suhl and B. T. Matthias (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 2, 5-6(1959) Jan. 1.

The theory of superconductivity is discussed in view of previous theories and experiments. It was previously suggested that the depression of the superconducting transition temperature of lanthanum as a function of rare earth impurity content may be traced to the exchange interaction between the conduction electron spins and the f-shell spins of the rare earth ions and conduction electrons interact via the ionic spins to modify the effective "V." From present and previous works, it is concluded that the important course of the depression of Tc by exchange scattering is the disparity in the free-energy depressions of the normal and superconducting states. "Shift V" effects, whether due to changes in wave function or due to electron interactions via virtual states, are small by comparison. The exchange energy between conduction electrons and ionic spins necessary to account for the observed reductions in Tc is 0.15 volt. (J.H.M.)

4209

CLUSTER DEVELOPMENTS FOR JASTROW WAVE FUNCTIONS II. INTRODUCTION OF IRREDUCIBLE CLUSTER FUNCTIONS. C. D. Hartogh and H. A. Tolhoek (Univ. of Leiden). Physica 24, 875-95(1958) Nov.

In a previous paper (Physica 24, 721(1958)) a cluster development of the k-particle distribution function, $g_k(r^k)$, for a system of interacting fermions in the ground state represented by a Jastrow wave function was considered. It was written as $g_k(r^k) = n^k \sum_{l=k}^{\infty} b_{k,l}(r^k)$ (n particle density), where $b_{k,l}(r^k)$ denotes the cluster integrals. In this paper a reduction is carried out by means of the introduction of irreducible cluster functions and the use of certain combinatorial methods. The reduction results in a development of $g_k(r^k)$, in which the $b_{k,l}(r^k)$ are replaced by simpler terms, which are sums of cluster integrals involving irreducible cluster functions only. The presentation includes a generalization to mixtures of fermions of different types. (auth)

4210

CLUSTER DEVELOPMENTS FOR JASTROW WAVE FUNCTIONS III. EXPRESSIONS FOR THE DISTRIBUTION FUNCTIONS AND THE ENERGY; APPLICATION TO NUCLEAR MATTER; EXPANSIONS AT LOW TEMPERATURE. C. D. Hartogh and H. A. Tolhoek (Univ. of Leiden). Physica 24, 896-909(1958) Nov.

The cluster developments for Jastrow wave functions, formulated in two previous papers, are extended to particles with spin. Explicit results are given for the distribution functions and the energy, including the case of fermion mixtures. A discussion is given of the application of the method to nuclear matter. The splitting into a "statistical" part and a "dynamical" part can also be made for a Bose or Fermi gas at low temperature. It leads to the introduction of more detailed cluster integrals. In the fugacity expansion of the pressure and the density, they can be rearranged, roughly to increasing powers of (δ/λ) (δ, range of the forces; λ, the De Broglie wave length). (auth)

4211

MAGNETORESISTANCE AND FERMI SURFACE OF ALKALI METALS. F. Garcia-Moliner (Univ. of Cambridge, Mass.). Proc. Phys. Soc. (London) 72, 996-1000(1958) Dec. 1.

The observed magnetoresistance effects in low fields are used for an approximate estimate of the anisotropy of the Fermi surfaces of alkali metals. The elements appear to be arranged in order of increasing anisotropy as follows: sodium, rubidium, potassium, cesium, and lithium. The Fermi surface in sodium is almost spherical. In lithium it is considerably anisotropic and it might even contact the Brillouin zone boundary. (auth)

4212

RELATIVISTIC THEORY OF POLARIZATION EFFECTS. Yu. M. Shirokov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 1005-12(1958) Oct. (In Russian)

A relation was obtained which connects the product of the wave functions of two free relativistic particles of given mass and spin with the wave function describing the free motion of the system as a whole. The relation is an analog of the Clebsch-Gordan relation for summation of angular momenta. Formulas for polarization and correlation of relativistic effects can be derived with the aid of the relation. Lorentz transformations for arbitrary tensor moments were obtained. (tr-auth)

RADIATION EFFECTS ON MATERIALS

4213 AD-201196

Army Signal Research and Development Lab., Fort Monmouth, N. J.

EFFECTS OF IRRADIATION ON QUARTZ AND QUARTZ CRYSTAL UNITS RECORDED EXPERIMENTS—A BIBLIOGRAPHY. Technical Memorandum M-1892. R. Bechmann. May 26, 1958. 38p.

Quartz crystal units used for frequency control are to some extent affected by irradiation. Known information regarding radiation effects on quartz and quartz

vibrators taken from available literature are assembled. (auth)

4214 APDA-122

Atomic Power Development Associates, Inc., Detroit.

THE APDA IRRADIATION TEST PROGRAM ON SELECTED URANIUM FUEL ALLOYS [FOR] JUNE 1954–JUNE 1957. A. Del Grosso and D. O. Leeser. 53p.

The APDA irradiation test program from June 1954 to June 1957 for fuel materials included binary alloys of U–Cr, U–Zr, and U–Mo. It was shown that the U-5 wt. % chromium eutectic alloy does not have radiation stability. Irradiation of U–Zr alloy specimens containing 2, 2.2, 3, 5, 10, and 15% by weight of zirconium indicates that the radiation stability is inferior to the U–Mo alloys containing $3\frac{1}{2}$, 5, 7, and 10% by weight of molybdenum. The U-10 wt. % Mo alloy was selected as the reference fuel alloy for the Enrico Fermi Reactor, and tests to cover high burn-ups of this material under several conditions were completed. Post-irradiation measurements of density, dimensions, electrical reactivity, fission gas, and thermal conductivity were conducted on specimens irradiated from 0.36 to 1.4 total atom % burn-up. The results of the irradiations indicate that the retained gamma structure of the U-10 wt. % Mo alloy is more stable than the partially transformed or the transformed alpha-plus-epsilon structures. However, none of the irradiated specimens of U-10 wt. % Mo showed severe dimensional changes. The average decrease in density of test specimens with retained gamma, partially transformed, and transformed alpha-plus-epsilon structures was determined to be 2.4, 3.3, and 3.9% per total atom % burn-up, respectively. (auth)

4215 APEX-438

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

APPLICATIONS AND REQUIREMENTS FOR THERMAL INSULATION IN NUCLEAR REACTORS. C. G. Collins and G. W. Pomeroy. Dec. 17, 1958. 23p. Contract AF33(600)-38062 and AT(11-1)-171. $0.75(OTS).

Applications and requirements are considered in the selection of materials for thermal insulation in a nuclear reactor environment. Important materials criteria include the concentration of neutron absorbers and the stability of the material under bombardment by nuclear particles. The concentration of neutron absorbers should be minimized in insulation materials used in the reactor core or in areas where personnel access is required. From the standpoint of stability to radiation, organic materials are limited to areas outside the reactor core or its immediate vicinity; inorganic or ceramic materials appear suitable for use in any reactor application. Since some inorganic solids expand during irradiation, fibrous and pellet types of insulation are the most promising for applications inside the reactor or on its surface. (auth)

4216 BNL-2431

Brookhaven National Lab., Upton, N. Y.

A METHOD FOR THE IMPROVEMENT OF THE BONDING PROPERTIES OF POLYETHYLENE BY GAMMA IRRADIATION. R. N. Chapman and P. Colombo. Aug. 1955. 3p. $1.80(ph OTS); $1.80(mf OTS).

Research was conducted in an effort to change the innate incompatibility of polyethylene to printing ink. Samples of this material were irradiated in a hollow cylindrical Co^{60} source ranging from 200,000 r/hr to 1,300,000 r/hr for varying doses at standard conditions of temperature and pressure. Those which had received a total dose of 0.5 to 20 megaroentgens exhibited excellent ink-retention qualities, comparing favorably with the properties of commercially treated polyethylene. (J.R.D.)

4217 CRMet-809

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE SWELLING OF BERYLLIUM FROM NEUTRON-INDUCED GASES. C. E. Ells. Nov. 1958. 39p. (AECL-719). $1.00(AECL).

Specimens of beryllium which had received an irradiation in the Materials Testing Reactor up to an integrated fast flux of 10^{22} nvt have been examined after annealing at various temperatures above 400°C. These annealing treatments have resulted in significant decreases in over-all density of the beryllium specimens, the density decrease being 0.8 and 20% after annealing for one hour at 600 and 995°C, respectively. The quantity of neutron-induced gases contained in the beryllium was determined to be approximately 23 cc of gas per cc of beryllium for an integrated fast flux of 10^{22} nvt. Analysis of the gas shows that it is mainly He^4. The results of the investigation suggest that the neutron-induced gases will not be a serious deterrent to the use of beryllium in reactor applications at temperatures up to 600°C. (auth)

4218 HW-52030 RD

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIATION DAMAGE TO GRAPHITE AT 500°C. W. A. Snyder. Sept. 23, 1957. 11p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Property changes in graphite resulting from irradiation at 500°C are presented. The damage sustained during high-temperature irradiation of coke material is a function of its crystallite development, the better development affording greater stability. The bulk contraction, however, is not a function of the changes within the crystallite but must be accomplished by changes among the crystallites. Ungraphited residue remaining from the binder material and surrounding the coke particles may allow a slight shifting of the coke particles which results in closer packing and bulk contraction. This explains the difference in radiation damage of graphite samples with the same crystallite parameters but made of different raw materials. (J.R.D.)

4219 NP-7097

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON GLASS. Technical Memorandum No. 9. W. C. Riley, W. G. Coppins, and W. H. Duckworth. Nov. 30, 1958. 25p. Project No. 2133. Contract AF33(616)-5171.

Currently, the primary interest in glass for nuclear-powered aircraft applications is in optical systems, electron tubes, and dosimetry. Coloration is undesirable in optical systems and may render them useless. Radiation damage to glass has resulted in mechanical failure of electron tubes. The dosimeter application, on the other hand, depends on irradiation-induced coloration of glass. Available information on radiation effects in glass is presented, and areas that require further investigation are recommended. (auth)

4220

EFFECT OF HIGH ENERGY RADIATION ON HYDROCARBONS OF THE LUBRICANT CLASS. Michael F.

Hoare. Inds. atomiques 2, No. 9-10, 102-8(1958). (In French)

The irradiation of hydrocarbons produces ions and excited species. These decompose to give free radicals which are responsible for the final products. The reactions which the free radicals undergo depend on the physical and chemical conditions. At moderate temperatures, there are few secondary reactions between the free radicals, except in the case of olefinic substances. At high temperatures, the radicals produce cracking reactions in the chain. At normal temperatures the aromatics resist radiation best because of their capacity to absorb the energy at a level which does not cause dissociation of the molecule. (J.S.R.)

4221

ALPHA-PARTICLE IRRADIATION OF Ge AT 4.2°K. G. W. Gobeli (Purdue Univ., Lafayette, Ind.). Phys. Rev. 112, 732-9(1958) Nov. 1.

Degenerate n- and p-type germanium samples were irradiated at 4.2°K with polonium alpha-particles. The irradiation removed carriers at a rate of 2.84×10^4 electrons/α-cm in n-type samples and 1.32×10^4 holes/α-cm in p-type samples. Thermal recovery was studied up to 78°K. No measurable recovery was observed below 22°K. Upon warming to 78°K the irradiation-induced changes of Hall coefficient decreased by about the same fraction, 25 and 22%, respectively, in n-type and p-type samples, showing that the same fractions of donor and acceptor defects were annealed out. Experiments made with various annealing procedures, using electrical resistivity as a measure, indicated that there were two distinct regions of thermal recovery, with maximum rates of change occurring near 33 and 67°K. The low-temperature process appears to follow a first-order reaction with a unique activation energy of about 0.02 ev. It may be due to the recombination of interstitials with nearby vacancies. The higher temperature process does not yield to simple analysis. (auth)

4222

THE EFFECTS OF PILE-IRRADIATION ON U_3Si. M. L. Bleiberg and L. J. Jones (Westinghouse Electric Corp., Pittsburgh). Trans. Met. Soc. AIME 212, 758-64(1958) Dec.

Specimens of U–3.8 wt.% Si, heat treated to produce the ϵ intermetallic compound (U_3Si), were irradiated to a maximum exposure of 0.104 at.% burnup and at a maximum in-pile temperature of less than 250°C. The irradiation produced large changes in hardness, density, electrical resistivity, and mode of corrosion in 650°F water. The microstructure of the samples appeared unchanged but no x-ray-diffraction lines were observed after the irradiation. These results were tentatively explained on the basis of a neutron-induced disordering reaction. (auth)

RADIOACTIVE WASTE

4223 HW-56001 A

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERIM REPORT NO. 2 ON INTERNAL CHEMICAL DECONTAMINATION THROUGH REACTOR DECONTAMINATION WITH TURCO 4306-B. H. F. Jensen. July 1, 1958. 18p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

A series of tests were conducted at the KE-, KW-, and DR-Reactors to evaluate a method for decontaminating the reactor rear face by flushing a chemical cleaner, Turco 4306-B, through the process tubing from front to rear and out the normal effluent discharge. Corrosion results indicate that the Turco 4306-B is only mildly corrosive to Al even at a concentration of six ounces per gallon and a twenty-minute flush. A six-ounce-per-gallon concentration for twenty minutes gives a reproducible gamma reduction of 50%. The tests to date indicate decontamination efficiency to be primarily a function of Turco 4306-B concentration and period of flush. (W.L.H.)

4224 HW-56001 B

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERIM REPORT NO. 3 ON INTERNAL CHEMICAL DECONTAMINATION WITH TURCO 4306-B. C. J. DeBevec and T. D. Dow. July 31, 1958. 5p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The results of a decontamination test of reactor process tubes with Turco 4360-B cleaner prior to removal from the reactor are reported. The test was accomplished by flushing 64 tubes with six-ounce-per-gallon solutions of Turco 4306-B at 50°C with a flow of five gpm for various lengths of time. The airborne contamination level on both the front and rear faces during the tube replacement program were lower than two previous tube outages by a factor of ten. (W.L.H.)

4225 HW-56001 C

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERIM REPORT NO. 4 ON INTERNAL CHEMICAL DECONTAMINATION; REAR FACE PROCESS PIPING ONLY WITH TURCO 4306-B. H. F. Jensen. July 31, 1958. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Data are presented on the chemical decontamination of rear-face piping at the KW- and DR-Reactors with Turco 4306-B. The intent of these tests was to establish procedures for rear-face-only decontamination as an alternate method until through-pile decontamination is fully proven. The contamination of DR provided immediate benefits in reduction of rear-face radiation levels. The test at 105-KW was limited to the decontamination of five crossheaders to establish procedures for full rear-face decontamination. (W.L.H.)

4226

THE VARIATION OF EFFLUENT CONCENTRATIONS DURING TEMPERATURE INVERSIONS. M. E. Smith, I. A. Singer, F. E. Bartlett, and L. Marcus (Brookhaven National Lab., Upton, N. Y.). J. Air Pollution Control Assoc. 7, 194-7(1957) Nov.

Inversion concentration data obtained at Brookhaven from a 355-ft test stack facility are presented and analyzed. The data reveal that diffusion within the first mile from the source agrees with the pattern suggested by Barad, in which an initial aerodynamic diffusion is followed by a very gradual natural one. (J.H.M.)

4227

THE DISPERSION OF STACK GASES IN STABLE ATMOSPHERES. Glenn R. Hilst (General Electric Co., Richland, Wash.). J. Air Pollution Control Assoc. 7, 205-10(1957) Nov.

Attempts to measure the diffusion and transport of materials emitted continuously from an elevated point source into stably stratified atmospheres are reported. Also, the potential hazards and benefits which may arise from such emissions are discussed. Conclusions

from these studies indicate that: the concentration of stack effluents, when measured over a grid fixed with respect to the ground, is decreased significantly by large-scale diffusion; the diffusive capacity of stable atmospheres is quite variable from one time to another and no single set of diffusion parameters can be assigned to stable atmospheres per se; Sutton's diffusion model appears to be adequate for the specification of the horizontal diffusion rate but fails in the specification of the vertical diffusion rate; and the vertical distribution of concentration appears to depend strongly upon the Richardson number. (J.H.M.)

4228
DISPOSAL OF GASEOUS EFFLUENTS FROM NUCLEAR POWER PLANTS. B. H. Hamling and G. F. Jenkins (Union Carbide Nuclear Co., New York). J. Air Pollution Control Assoc. 7, 256-61(1958) Feb.

Information is presented on the disposal of gaseous wastes from nuclear power installations. Discussions are included on: hazards and sources of radioactive air contaminants; reactor types and supporting facilities; waste disposal facilities; and measurement and monitoring of airborne activity. (J.H.M.)

4229
CONVERSION OF LIQUID WASTES TO SOLIDS. Nuclear Energy Engr. 12, 430-3(1958) Dec.

A method for the conversion of liquid wastes to solids, which makes use of the process of fluid-bed calcination, is described. The calciner consists of a cylindrical vessel containing a bed of granular oxide, consisting of the product obtained from the evaporation and calcination of the waste solution. For aluminium-nitrate-bearing waste, the granular bed would consist of aluminium oxide together with other minor constituents including fission product oxides. The bed could consist of almost any inexpensive, inert, porous solid for wastes of low solid content. In order to study the process, a unit was constructed at Argonne National Laboratory for semi-remote operation. The unit was designed to use diluted radioactive waste, and is capable of handling about 100 curies of 1 Mev gamma radiation. A schematic of the facility is shown. (J.H.M.)

4230
ECOLOGICAL STUDIES IN RADIOACTIVE WASTE DISPOSAL AREAS. S. I. Auerbach (Oak Ridge National Lab., Tenn.). Proc. of the First Annual Texas Conf. on the Utilization of Atomic Energy, 42(1958) Aug.

Ecological investigations by the Oak Ridge National Laboratory of large field areas contaminated by waste disposal operations are reviewed. Discussions are included on the movement and uptake of ruthenium-106 by mixed deciduous and conifer tree species growing in the vicinity of radioactive waste pits and the ecological system developing on the contaminated White Oak Lake Bed. (J.H.M.)

REACTORS

General

Refer also to abstracts 4325, 4334, 4335, 4341, 4349, 4350, 4351, 4352, 4353, 4354, 4366, 4369, and 4370.

4231 AECU-3969
General Electric Co. General Engineering Lab., Schenectady, N. Y.
IMMEDIATE DETECTION OF LARGE FUEL ELEMENT FAILURES. R. A. Dewes. Dec. 3, 1958. 26p. (58-GL-331). $4.80(ph OTS); $2.70(mf OTS).

An investigation is made of considerations pertaining to the immediate detection of a fuel element failure of the order of 100 cm^2 of exposed fuel alloy, under certain conditions and requirements. The problem is viewed in the light of S3G conditions. Of the methods considered, fission gas detection is concluded to offer the best possibilities for immediate failure detection. A good choice of instrumentation for the detection of the fission gases is not given. Various types of detectors are considered, and it is recommended that a choice wait upon experimental evaluation. (auth)

4232 AERE-R/R-818
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
TWO GROUP THEORY OF CONTROL RODS IN A THERMAL REACTOR. J. Codd and C. A. Rennie. 1952. Changed from OFFICIAL USE ONLY Nov. 5, 1958. 13p.

Approximate formulas are obtained on two-group neutron diffusion theory for estimating the effectiveness of completely inserted cylindrical control rods which are situated parallel to the axis of a bare cylindrical reactor. It is assumed that the control rods are black to thermal neutrons but do not absorb neutrons of higher energies. The cases investigated include a central control rod, an excentric control rod, and a concentric ring of equally spaced control rods. (auth)

4233 AERE-R/R-2597
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
EXPONENTIAL EXPERIMENTS WITH NATURAL AND SLIGHTLY ENRICHED URANIUM, GRAPHITE MODERATED SYSTEMS. D. J. Lockey, H. Pearson, A. L. Pope, and G. M. Wells. Sept. 1956. Decl. May 1958. 54p. $1.26(BIS).

Declassified version of AERE-R/R-2014.

An account is given of graphite exponential experiments which extend the range covered previously. An improved method of analysis is employed. The results are compared with the lattice calculations recommended for PIPPA type reactors, and proposals are made for further work. (auth)

4234 ANL-5828
Argonne National Lab., Lemont, Ill.
EQUILIBRIUM P-V-T RELATIONS FOR EXPANDING LIQUID-VAPOR SYSTEMS IN A CONTAINMENT SHELL. J. C. Heap. Nov. 1958. 50p. Contract W-31-109-eng-38. $1.50(OTS).

From a time-independent standpoint, formulas are developed for determining a containment shell for a reactor plant should an unforeseen malfunction, where a compressed liquid, liquid-vapor, or vapor system is liberated and expands, occur. From the thermal equilibrium states, the pressure build-up inside a containment shell of known free volume is obtained, or for a specified containment shell pressure the required free volume is evolved. For the pressure build-up inside a containment shell due to an incident on a time-dependent basis, formulas are evolved from an open-system aspect. A table and graphs for various initial states expanding into a containment shell have been prepared, where time is not considered. Examples illustrating the usage of the developed time-independent equations are given. (auth)

4235 ANL-5933
Argonne National Lab., Lemont, Ill.
SODIUM AND BISMUTH LIQUID METAL FUEL SYSTEMS: A LITERATURE SEARCH TO JUNE 30, 1957. Richard C. Vogel and Walton A. Rodger. Nov. 1958. 54p. Contract W-31-109-eng-38. $1.50(OTS).

The literature on sodium, NaK, and bismuth liquid metal reactor fuel systems is reviewed to June 30, 1957. The various criteria which have been used for the selection of liquid metal fuel carriers are discussed. Corrosion information on each fuel carrier is summarized, and some discussion of the fabricability of components from possible materials of construction is included. Work done on the testing of various fuel concepts for each carrier is indicated. (auth)

4236 APEX-441
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
BORAX FUSE TESTS. S. N. Stilwell and R. L. Waterfield. Apr. 1955. 44p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.25(OTS).

Test results show that the type of fuse tested definitely reduces the total power generated in a reactor excursion. Subsequent analysis based on more detailed information has enabled the prediction of actual results within the probable accuracy of the factors involved. The large correction (0.444) for the geometry and self-shielding in the disk indicates that these factors should be considered simultaneously in determining the optimum uranium concentration to be used in future disks. The low relative flux (0.618) at the disk indicates the importance of positioning the fuse disk at the highest flux location in the reflector, since even at that point the flux will probably be far less than the average in the core on this type of reactor. More complete engineering knowledge of this type of fuse could be provided by future tests in which records are made of (1) the disk temperature up to the time it releases, (2) the actual time of release, (3) the pressure transient in the evacuated upper chamber (an indication of insertion speed), and (4) both transient and integrated flux at the disk. To evaluate completely the possibilities of this type of fuse, tests are also needed to determine how total excursion power varies with period for various numbers of fuses and for different poison loadings per fuse. (auth)

4237 APEX-442
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
LITERATURE SEARCH ON FAST REACTORS. Task 7271. D. E. Wetzel. Apr. 3, 1958. Decl. Oct. 7, 1958. 16p. (XDC-58-6-83). $3.30(ph OTS); $2.40(mf OTS).

Descriptions are given of geometries and compositions of fast reactor designs and experiments reported in the literature. Each description is divided into these categories; location, rating, fuel description, reflector, control, coolant, and remarks. Some experimental data are included. The reactor descriptions presented are those of the Clementine, EBR I, Topsy, Lady Godiva, Zephyr, ZPR III, Zeus, Dounreay, EBR II, and Enrico Fermi fast reactors. The data were collected as reference material for possible fast reactor neutron physics studies in support of advanced design work. (auth)

4238 ARF-D132K03-1
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF REACTOR CONTAINMENT. TASK ON STRUCTURAL AND MECHANICAL DESIGN CRITERIA FOR NUCLEAR REACTOR CONTAINMENT. AN ANNOTATED BIBLIOGRAPHY ON REACTOR CONTAINMENT. Report No. 1. Aug. 1958. 76p. Contract AT(11-1)-528. $2.25(OTS).

A survey of recent publications concerned with structural and mechanical aspects of nuclear reactor containment was conducted during the first phase period. This report presents an annotated bibliography of 279 such publications. Many of the references listed appeared in Nuclear Science Abstracts and were published in the period from 1954 through 1957. (auth)

4239 CEA-673 A
France. Commissariat à l'Énergie Atomique, Paris.
PURIFICATION PAR RESINES ECHANGEUSES D'IONS DE L'EAU LOURDE DES REACTEURS EL_1 ET EL_2. A. CONDUITE DE LA PURIFICATION. INSTALLATIONS ET RESULTATS. Cover carries title: PURIFICATION DE L'EAU LOURDE DES REACTEURS EL_1 ET EL_2. (Purification by ion exchange resins of the heavy water of the reactors EL_1 and EL_2. [Part] A. The purifying process. Equipment and results.) J. Chenouard and E. Roth. 1957. 45p.

The heavy water is purified by tapping off part of the moderator over a mixed bed of anion and cation exchangers. The heavy water leaving the columns has a resistivity reaching several megohms, which allows the resistivity of the moderator to be maintained between 10^5 and 10^6 ohms/cm. Two methods of deuteration of the ion exchangers are described, as well as the heavy water recovery from resins charged with radioactive products. The influence of the purity of the water on the radiolytic dissociation is investigated. An interpretation of the variations in pH and of the formation of hydrogen peroxide is given. In addition the report contains a general description of the EL 1 and EL 2 purification installations. (auth)

4240 CF-58-12-106
Oak Ridge National Lab., Tenn.
POWER RESPONSE FOLLOWING REACTIVITY ADDITIONS IN HRT. S. Jaye and M. P. Lietzke. Dec. 30, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations have been performed relating the magnitude of an HRT power excursion to an instantaneous addition of reactivity (up to 1% Δk_e). Five delayed neutron groups as well as separate heat balances over the core and blanket were accounted for in the calculation. (auth)

4241 HW-57424
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF A SCRAM ON THE LEVEL OF HEAVY WATER IN THE PRESSURIZER OF THE PRTR. R. W. Moulton. Sept. 12, 1958. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The primary coolant loop of the PRTR facility is a heavy water circulating system which is pressurized by helium. The helium gas maintains a constant pressure on the system and prevents boiling of the coolant. On a complete scram, the coolant will drop in temperature and approach the temperature of the steam generator. This reduction in temperature will cause a contraction of the coolant volume and a corresponding drop in level in the pressurizer vessel. The change, and the rate of change of level of D_2O in the pressurizer are examined. (auth)

4242 HW-57941

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NONDESTRUCTIVE TESTING OF MTR TYPE FUEL PLATES BY X-RAY ABSORPTION AND FLUORESCENCE TECHNIQUES. M. C. Lambert. Oct. 28, 1958. 32p. Contract W-31-109-Eng-52. $1.00(OTS).

Instrumentation and techniques are described for nondestructive analysis of flat reactor fuel plates consisting of a 20-mil core of plutonium–aluminum alloy covered on both sides by 20 mils of aluminum. Thickness of 11 wt. % and of 14 wt. % plutonium–aluminum cores (which can also be expressed as fuel density in mg/cm^2) was measured by absorption of polychromatic x rays in the range 0.010 to 0.030 in. with a sensitivity of ±0.0002 in. Every fuel plate prepared for the power loading was tested with the x-ray photometer. This method proved to be definitely superior in sensitivity, precision, and speed to the other nondestructive testing methods which had been tried. A 24-in. plate can be scanned in two minutes with the prototype photometer. An improved instrument, which can automatically scan fuel plates in either a linear or zig-zag pattern, was designed. X-ray fluorescence was used to measure aluminum cladding thickness over plutonium or uranium alloy cores. Precision (of ± 0.00025 to ± 0.00075 in. of aluminum) is discussed in terms of cladding thickness, aperture size, and counting time. (auth)

4243 IDO-16454

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTIVITY MEASUREMENTS IN THE ETR CRITICAL FACILITY. E. E. Burdick and J. W. Henscheid. July 10, 1958. 22p. Contract AT(10-1)-205. $0.75 (OTS).

This report was issued in preliminary form as PTR-273, dated Jan. 27, 1958.

The ETR Critical Facility went critical on May 20, 1957. Since then the program consisted of reactor check-out and accumulation of data which would aid in the startup of the parent reactor. The reactivity measurements indicate that, although the reactivity worth of both the safety rods and of the excess reactivity for the core were measured to be lower than the value calculated in the design of the reactor, the nuclear safety of the reactor will not be seriously affected. (auth)

4244 IDO-16464

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ETR CORE HYDRAULICS. R. G. Beck, E. S. Brown, and J. H. Rainwater. Sept. 18, 1958. 27p. Contract AT(10-1)-205. $1.00(OTS).

A pre-neutron hydraulic test was conducted in the ETR to check the hydraulic design of the reactor core and reflector, and to establish operating parameters that would provide safe operation of the reactor. Test results indicated the following design discrepancies: The core pressure drop required to provide an average coolant velocity of 35 ft/sec in fuel element coolant channels was 55 psi at a coolant temperature of 70°F. The corresponding design value was 42.0 psi. The core pressure drop that provides an average coolant velocity of 35 ft/sec in the coolant channels of the fuel section of a control rod was 64 psi at a coolant temperature of 70°F. The corresponding design value was 42.0 psi. A velocity difference of 20 to 25 per cent occurred among the ten instrumented channels of the two fuel elements and also among the 16 instrumented channels of the two control rod fuel sections. This was not anticipated in the design calculations. The fuel element flat plates buckled with an average coolant velocity of about 29 ft/sec. Design criteria required the fuel elements to withstand a velocity of 43 ft/sec. Three fuel elements, with vertical slots in the side plates designed to equalize lateral pressures, were also tested in the core and did not buckle when exposed to an average coolant velocity of 39 ft/sec. The total reactor flow required to provide an average coolant velocity of 35 ft/sec in the fuel elements was 55,000 gpm with a core pressure drop of 55 psi. The design reactor flow rate was 44,000 gpm at a core pressure drop of 42 psi. (auth)

4245 KLX-1789

Vitro Engineering Co., New York.

PRELIMINARY HAZARDS REPORT TO THE ATOMIC ENERGY COMMISSION FOR THE CORNELL UNIVERSITY DUAL CORE REACTOR. Vitro Job No. 1243. L. Geller. Jan. 17, 1958. 111p. $21.30(ph OTS); $6.90(mf OTS).

A dual-core reactor facility is proposed having an intermediate power "swimming pool" core and a "zero power" quasiflexible critical studies core. The facility design also incorporates a gamma irradiation cell. It is planned to operate both cores at the same console but not at the same time. All possible sources of radiation will be shielded, either through the use of water, ordinary concrete, barytes concrete, or other special materials according to the best calculation techniques available. Under normal operating conditions exposed areas will receive no more than 0.2 mr/hr. (W.L.H.)

4246 NP-7176

Lockheed Aircraft Corp., Marietta, Ga.

THE COMPUTATION OF GAMMA ACTIVITY AND RELATED EFFECTS FROM THE CYCLIC OPERATION OF A U^{235} REACTOR. M. O. Burrell, G. E. Duncan, and J. F. Perkins. Aug. 1958. 27p. Contract AF33 (600)-32055. (NR-39).

Fission product decay following shutdown of a reactor is important from the standpoint of both shielding and cooling requirements, and fission product inventory is also a significant factor in determining radiation exposures that might result from a reactor accident. Decay properties of mixed fission products have been computed in several applications by summing contributions from individual nuclides of known fission yield and decay scheme. Because of the scarcity of decay schemes for nuclides of short half life, however, these previous studies have not extended back to times shorter than 30 minutes after shutdown, whereas decay rates at considerably shorter times are quite important, for instance in connection with meltdown accident. In the present study, the best available decay schemes have been obtained for all fission product nuclides with half lives greater than one minute and cumulative fission yield greater than 0.05%. Calculations were extended to times as short as 100 seconds after shutdown though the results were not expected to be reliable below about 5 minutes after shutdown. This report describes the development of the equations used in calculating the rates of decay and energy release from fission products and their solution by means of an IBM-704 computer. The appendix gives detailed instructions concerning preparation of input data and use of the computer program. The program treats a doubly cyclic reactor operating schedule. This may, of course, be specialized to the

simpler case of a single period of constant power operating, which is the case treated in previous studies of this type. (auth)

4247 TID-7017
Oak Ridge National Lab., Tenn.
REACTOR MATERIAL SPECIFICATIONS. R. M. Evans, comp. and ed. Oct. 29, 1958. 252p. Contract W-7405-eng-26. $4.00(OTS).

Material specifications are given for tubes, plates, rods, etc., of Inconel, Hastelloy B, and austenitic stainless steel. Procedures are specified for welding these materials to various alloys in different thicknesses. Inspection procedures are given. (W.D.M.)

4248
THE CHANGE FROM DIPOLE SINGULARITY IN THE CALCULATION OF HETEROGENEOUS REACTORS. H. Stippel (Univ. of Graz, Austria). Acta. Phys. Austriaca 12, 123-43(1958). (In German)

The basic equations of the source and sink method are given and generalized for dipole interactions between fuel elements. The interaction integral is derived. (J.S.R.)

4249
REPLACEMENT OF FUEL BY GRADUATED ZONE OF IRRADIATION. Hoang Xuan Han. Inds. atomiques 2, No. 9-10, 69-79(1958). (In French)

It was proposed that, in a graphite-moderated natural uranium reactor, the fuel elements be replaced according to the following method. At each discharge of a channel, move the lower fourth of the fuel elements to the top. Group the channels in relatively small zones, called discharge zones, and program the replacement so that at the end of a certain time the channels of a zone would have, horizontally, regularly stepwise irradiations up to the limit permitted by the cladding behavior. Replace later the upper three-fourths of each channel at the time when certain points reach the irradiation limit. These ideas on discharge and reloading are studied and generalized. The effects of various factors in the programming on fuel economy at different periods of utilization of the reactor are emphasized. (J.S.R.)

4250
MEASUREMENTS OF NEUTRON FLUX IN NUCLEAR REACTORS. V. S. Ermakov (Inst. of Power Engineering, Academy of Sciences, Belorussian SSR). Inzhener. Fiz. Zhur. Akad. Nauk B.S.S.R. 1, No. 2, 113-17(1958) Feb. (In Russian)

Problems associated with neutron flux measurements in reactors are discussed. Descriptions are given of the ionization chamber used in England for measuring flux in experimental power reactors. (tr-auth)

4251
INTENSIFICATION OF HEAT TRANSFER IN A GAS-COOLED NUCLEAR REACTOR. F. Berger and V. Stach. Jaderná energie 4, 251-6(1958) Sept. (In Czech.)

The possibility of increasing heat transfer from the surface of a fuel element to the coolant gas is discussed. Laboratory experiments (non-reactor) show that heat transfer can be increased by producing an intense electric field at the heat transfer surface. This effect was studied from the point of view of the specific conditions in the cooling-channels of a gas-cooled nuclear reactor. Because the coolant gas in such a reactor is partially ionized by radiation much lower electric field-intensities are sufficient. (tr-auth)

4252
REACTOR SHIELDING ANALYSIS. C. C. Horton (Rolls-Royce, Ltd., Derby, Eng.). Nuclear Eng. 3, 515-20 (1958) Dec.

The present state of knowledge and problems in the design of biological shielding for reactors are reviewed. The essential differences between shielding analysis and core design physics are discussed. (J.H.M.)

4253
AN ULTIMATE SAFETY DEVICE FOR THERMAL REACTORS. A. C. Hughes (Hawker Siddeley Nuclear Power Co., Ltd.). Nuclear Eng. 3, 521-2(1958) Dec.

A reactor control safety device that is placed inside the reactor and requires no external signal is described. The automatic device is temperature-sensitive and will shut down the reactor when the components reach a high temperature (~650°C). It is particularly useful in providing additional safety for reactors which may have a positive temperature coefficient of reactivity. The basis of this device is a material which is a high absorber of thermal neutrons. The material is in such a form that the poisoning effect on the reactor is very small at normal operating temperature, but considerable above some predetermined "danger" temperature. This can be achieved by choosing a highly absorbing material in a solid or liquid state, which is arranged to have a small surface/mass ratio so that the effective absorption cross section is very much less than the potential cross section in the dispersed state. To meet particular conditions it is necessary to choose a material which changes to the gaseous state at the required temperature. It is suggested that mercury is a suitable absorbing material for Calder-type reactors and the more stable boron hydride compounds are suitable for research reactors that utilize low temperatures. (J.H.M.)

4254
PRESSURE VESSEL NOZZLE DESIGN. A NEW APPROACH TO REINFORCEMENT. R. T. Rose. Nuclear Eng. 3, 523-8(1958) Dec.

New methods of approach to the problem of reinforcing branch connections (nozzles) for pressure vessels are reviewed. Discussions are included on: stress testing of unreinforced and reinforced nozzles, pulsating pressure testing of nozzles, and the testing of various pressure vessel materials. (J.H.M.)

4255
PHYSICAL FACTORS OF A LOW-POWER MEDICAL REACTOR. Thomas E. Shea and Robert Sharp (U. S. Naval Hospital, Bethesda, Md.). Radiology 71, 852-5 (1958) Dec.

Design characteristics, operation, and physical factors are described for a homogeneous, solid-fuel 5-watt reactor installed at the U. S. Naval Hospital at Bethesda. The reactor forms an integrated part of the isotope branch of the Radiology Service of the hospital. The reactor is expected to augment an extensive radioisotope service for both diagnosis and treatment. (C.H.)

4256
THE AGN-201-M REACTOR THERMAL COLUMN. F. W. Chambers, Jr. and J. W. Duckworth (National Naval Medical Center, Bethesda, Md.). Radiology 71, 868-70(1958) Dec.

In addition to its primary value for clinical use, the 5-watt medical research reactor at the U. S. Naval Hospital provides a potentially valuable tool for biological research. Calculations were made on the available flux of the various radiations at different

energy levels in the thermal column. Data are presented graphically. The problem of maintaining sufficient reactivity for criticality was also investigated. Problems of operation are discussed. (C.H.)

Power

4257 AECU-3909

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE ARMOUR DUST FUELED REACTOR (ADFR). D. Krucoff. [1958]. 18p. Contract AT(11-1)-603. $3.30(ph OTS); $2.40(mf OTS).

The ADFR is based on the use of a fissionable dust carried in a gas. This fuel form offers promise of a major economic advance through the use of 2,000 to 3,000°F operating temperatures and a low cost fuel cycle. The development program is described that was initiated to investigate experimentally the proposed fuel and study analytically other reactor characteristics. A brief review of the reactor concept is presented. (W.D.M.)

4258 AECU-3910

Allis-Chalmers Mfg. Co. Nuclear Power Div., Milwaukee.

PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT [FOR] JULY 1, 1958—SEPTEMBER 30, 1958. Oct. 15, 1958. For Northern States Power Company and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. (ACNP-5812). $13.80(ph OTS); $4.80(mf OTS).

Preliminary design data for the reactor with a nuclear superheater are given. The fuel element cladding material has been designated as X 8001 aluminum alloy. Corrosion testing of X 8001 is described. Welding experiments of end caps of several designs were conducted. A new core layout is described. Modifications to the boiler fuel elements are discussed. The reactor vessel design was revised slightly. Progress on some of the more important design elements is discussed. A preliminary stress analysis was made of the lower head design. The first silicone rubber seal was tested to failure and the test history is given. A piping flexibility analysis for recirculation piping was performed. Modifications to the recirculation pumps are described. The thermal constants, microscopic cross sections, and diffusion coefficient were calculated for various core regions utilizing the Sufocate code. A study is presently being made to determine the effect of irradiation history on reactivity, power and void distributions, and isotopic densities of various elements so that core lifetime, control requirements, and reloading schedules may be established. An experiment is described to measure the reactivity change caused by flooding of the steam passages of the superheater elements with moderator. Using a preliminary layout for the turbine building, dose rates at various positions were calculated. The investigation of system stability required for the Preliminary Safeguards Report was completed. A test was conducted to determine the effect of a power excursion in the critical facility reactor on the void simulator material. Startup and shutdown procedures are listed. (For preceding period see AECU-3782.) (W.D.M.)

4259 AECU-3942

Duquesne Light Co., Shippingport, Penna.

MONTHLY OPERATING REPORT [FOR] AUGUST 1958. George Rifendifer. 50p. Contract AT(11-1)-292. $7.80(ph OTS); $3.30(mf OTS).

Shippingport Pressurized Water Reactor operating experience is summarized. One safety shutdown and four incidents are reported. Data from chemical analyses of coolant and boiler water are given. Work on neutron detecting devices of the Nuclear Instrumentation System is described. The Primary Plant Instrumentation System was modified for the new operating conditions of 1800 psig and 500°F. A Reactivity Lifetime Test was performed. Maintenance and operational training continued. (T.R.H.)

4260 AECU-3944

Duquesne Light Co., Shippingport, Penna.

CALIBRATION AND INTERCOMPARISON OF CONTROL RODS. SECTION I. FIRST PERFORMANCE. Test Results DL-S-150 (T-550131). First Issue, Oct. 28, 1958. 12p. $3.30(ph OTS); $2.40(mf OTS).

Determination was made of the symmetry of the Shippingport Pressurized Water Reactor core, rod worths for rods on inverters 1 and 5 and reactivity of the core with one rod on inverter 4 or 8 stuck at the top. The core was symmetrical, at the time of this test, with respect to power generation at the power levels specified in the Test Procedure (5 decades above source maximum). The source range and intermediate range instrumentation showed various sections of the core to become critical at different rod heights. This could be attributed to the shielding effect created with respect to the nuclear instrumentation detectors by withdrawing a single rod. (auth)

4261 AECU-3948

Duquesne Light Co., Shippingport, Penna.

CONTROL ROD DRIVE MECHANISM PRECRITICAL AND INITIAL CRITICAL TESTS. SECTION I. Test Results DL-S-158 (T-550010). First Issue, Aug. 21, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

The Shippingport Pressurized Water Reactor control rod drive stator winding resistances were ~7% greater than the expected 15.9 ohms ±2.5%. (T.R.H.)

4262 AECU-3949

Duquesne Light Co., Shippingport, Penna.

CORE INSTRUMENTATION CALIBRATION. SECTION III. Test Results DL-S-162 (T-550128). First Issue, Aug. 28, 1958. 8p. $1.80(ph OTS); $1.80(mf OTS).

The calibration of PWR core thermocouples is presented. With the plant at ~450°F, 1200 psig, and steady state conditions, recordings were taken from core thermocouples for calibration purposes. A number of core thermocouples was found to read erroneously and have apparently failed. (W.L.H.)

4263 AECU-3950

Duquesne Light Co., Shippingport, Penna.

STATION SHUTDOWN TEST. SECTION I. Test Results DL-S-168 (T-554929). First Issue, Sept. 16, 1958. 10p. $1.80(ph OTS); $1.80(mf OTS).

The plant operating performance during a hot shutdown for capacity reduction is determined. The operating procedure is adequate for the performance of a hot shutdown for capacity reduction. The station was shutdown in accordance with the method outlined in Volume I, Chapter 45, Part I—"Hot Shutdown for Capacity Reduction," dated January 17, 1958. The method outlined in this chapter was followed with the exception of steps 13, 15, 17, and 21 which consist of program shutdown of reactor decay heat valve operation, and rod control sys-

tem shutdown. Plant performance data were obtained, and comments as to effectiveness were made during the operation. The test was performed during each of two shutdown operations. (auth)

4264 AECU-3956
Duquesne Light Co., Shippingport, Penna.
RADIATION SURVEY AFTER SHUTDOWN. Test Results DL-S-184 (T-612076). First Issue, Sept. 12, 1958. 11p. $3.30(ph OTS); $2.40(mf OTS).

A radiation survey is presented for the 1D Boiler Compartment and the Reactor Chamber after the reactor is shutdown. The radiation level in the 1D Boiler Compartment follows a general decay rate throughout the compartment. The decay rate was as expected. The radiation level in the compartment immediately after shutdown was somewhat less than expected. This radiation survey was performed after the plant had been operating at 100% power for 100 hours. (W.L.H.)

4265 AECU-3959
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF REACTOR CONTAINMENT. Combined Monthly Progress and Financial Status Report No. 19. T. A. Zaker. Dec. 12, 1958. 7p. ARF Project No. D132. Contract AT(11-1)-528. $1.80(ph OTS); $1.80(mf OTS).

Brief progress reports are given for studies on: shock crushing of reactor materials, explosive decompression of water resulting from pressure vessel rupture, and velocity of sound in reactor media. (For preceding period see AECU-3895.) (T.R.H.)

4266 AECU-3979
Duquesne Light Co., Shippingport, Penna.
PERIODIC VALVE OPERATING SYSTEM PERFORMANCE TEST. SECTION I. FIRST PERFORMANCE. Test Results DL-S-216 (T-641114). First Issue, Dec. 18, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

The purpose of this test is to determine that the system operating pressure is sufficient to meet system design requirements and also to check if leakage occurs through the hydraulic pilot valves. All main hydraulic stop valves operated within the prescribed time limits. Leakage from the system could not be determined because of the unavailability of a proper range test gage at the time the test was performed. The alignment check of the three-way selector valves was not performed because of insufficient match marks on the valves. (auth)

4267 AFOSR-TR-58-31
Escher Wyss GmbH, Zurich.
APPLICATION OF THE CLOSED-CYCLE PRINCIPLE TO AIRCRAFT PROPULSION SYSTEMS. VOLUME VII, CHAPTERS 1 TO 4. GASEOUS WORKING MEDIA FOR CLOSED CYCLE POWER PLANTS. (Cover carries title: CLOSED CYCLE AIRCRAFT PROPULSION SYSTEMS). W. Spillmann and B. Speckert. July 21, 1957. 32p. Contract AF61(514)-985. (AD-152240).

At the present state of the art, He, N_2, and CO_2 are considered feasible as working media in nuclear power plants. Particularly for a NAP-plant, helium seems to be the best suited gas with respect to radiation stability and resulting plant size. A great advantage is the excellent heat transfer properties of helium. They are of prime importance for the size of the heat transfer equipment, which naturally should be kept as small as possible for use in aircraft. In the cycles under consideration, gaseous mixtures might also be used as working media. (auth)

4268 AFOSR-TR-58-33
Escher Wyss GmbH, Zurich.
APPLICATION OF THE CLOSED CYCLE PRINCIPLE TO AIRCRAFT AUXILIARY POWER PLANTS. VOLUME IX. COMPARISON BETWEEN DIRECT AND INDIRECT HEAT ADDITION FROM AN ATOMIC REACTOR TO A CLOSED GAS TURBINE CYCLE. (Cover carries title: DIRECT AND INDIRECT ADDITION OF HEAT AND PUMPING POWER). Technical Note No. 5. R. Tognoni. July 21, 1957. 61p. Contract AF61(514)-985. (AD-152242).

To a gas turbine cycle heat can be added either by a heat source in the cycle itself, or through a heat exchanger in connection with an external heat source. The penalties for this second configuration have been investigated and its efficiency compared to the "simple" cycle. (auth)

4269 HW-54727(Add.)(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
AN ADDENDUM TO A PARAMETRIC STUDY OF THE GAS-COOLED REACTOR CONCEPT. Mar. 1, 1958. 251p. Contract W-31-109-Eng-52. $4.00(OTS).

This addendum to the report of parametric studies on the gas-cooled reactor concept was prepared to serve a twofold purpose: to provide background information regarding the study results presented in the first volume, and to provide additional information resulting from the studies made on the gas-cooled reactor concept which, though not directly applicable to the cases studied, may be of value in the evaluation of other studies of the gas-cooled reactors. Studies are presented on fuel elements, reactor physics, heat transfer and fluid flow, coolant gas selection, core arrangement and vessels, direct and indirect cycle power plants, and costs. (W.D.M.)

4270 KAPL-M-SSD-46
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEATE BOILING DETECTION SYSTEM DESIGN DESCRIPTION. L. R. Boyd. Feb. 19, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

The proposed instrumentation system for the detection of local nucleate boiling in the S3G reactor core is described. Boiling will be detected by ion chambers inserted into thimbles which enter the core. (W.L.H.)

4271 MND-1235
Martin Co. Nuclear Div., Baltimore.
THE ORIGIN AND DISPOSAL OF POWER REACTOR WASTES. George P. Dix, Richard C. Groscup, and John M. Leffler. Feb. 5, 1958. 104p.

A fundamental investigation was made of waste disposal pertinent to pressurized water power reactor types. A study of gas-cooled reactor types was included to determine the specific waste disposal aspects concerning a maritime gas-cooled reactor. The study included a thorough search of the current literature. The study encompasses only operational power reactor wastes and excludes the disposal of used fuel elements. The properties of light water, air, nitrogen, hydrogen, helium, and carbon dioxide were studied relative to their use as reactor coolants. The origin of reactor wastes is discussed at length. The waste collection components of a power reactor system are described in detail. Various methods of disposing of reactor wastes are outlined. A distinction is made between activation and fission products. A list is tabulated of

radioisotopes produced in coolants by activation during normal reactor operation. Design details are described of waste disposal systems of five operating or proposed power reactors. These include the Shippingport Pressurized Water, Army Package Power, Martin Pressurized Water, Maritime Gas Cycle, and the Calder Hall Reactors. The shielding of waste disposal systems is discussed. Methods of calculating radiation doses from reactor waste collection components of pressurized water reactors are outlined. Codes and standards are outlined which are applicable to waste disposal as set forth by the U. S. Atomic Energy Commission, Interstate Commerce Commission, and U. S. Coast Guard. A list of the permissible concentrations of radioisotopes in air and water is included. (C.H.)

4272 MND-RP-558-15
Martin Co. Nuclear Div., Baltimore.
ZERO POWER TEST STUDIES ON THE MARTIN POWER REACTOR. H. Rosenthal and W. Osmeyer. June 1958. 15p.

Presented before American Nuclear Society Annual Meeting, Los Angeles, California, June 2-5, 1958.

Zero power studies were made of the Martin Power Reactor to determine control rod worth and reactivity characteristics. Values are given for a series of rod arm lengths, rod configurations, and rod numbers. (D.E.B.)

4273 NAA-SR-2561
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
INTERIM REPORT ON NUCLEAR ANALYSIS OF SGR FUELING. T. J. Connolly. Oct. 15, 1958. 41p. Contract AT-11-1-GEN-8. $1.25(OTS).

The investigation of certain features of sodium-graphite-reactor design and operation relating to fuel costs was initiated, and the preliminary results are presented. These results include: the isotopic fuel composition as a function of extracted energy; the isotopic changes which occur as the parallel processes of fission and conversion proceed, related directly to the decline in value of the fuel and to the reactivity of the fuel; the effect of isotopic fuel composition changes on reactor-core reactivity and spatial distribution of core power generation; the gains in reactivity and/or specific power achievable by non-uniform core design; the non-uniformity effected through spatial variation of the fuel lattice, fuel element size, and/or fuel enrichment; and the effect of fuel programming (the various schemes for changing fuel elements in the core) on reactivity and specific power. (auth)

4274 PRDC-TR-14
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] AUGUST 1958. 13p. Contract AT(11-1)-476. $3.30(ph OTS); $2.40(mf OTS).

Results from fuel pin irradiations and nondestructive testing are given. Fuel cycle costs were prepared for various burnups and interest rates on fuel. Conclusions are drawn from fuel pin corrosion tests. Work on computer programs and pressure vessel engineering is reported. A sodium—water reaction test is described. Preliminary tests were run on the sodium vapor trap. Ultrasonic cleaning of dummy nozzles is described. (For preceding period see PRDC-TR-13.) (W.D.M.)

4275 PRDC-TR-15
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] SEPTEMBER 1958. 24p. Contract AT(11-1)-476. $4.80(ph OTS); $2.70(mf OTS).

Sample collection and analysis were started for the preoperational environmental survey. Reports on environmental radioactivity at various locations are attached. Samples of a fissium-type alloy were heated to 2000°F to determine the melting range. A chart showing the status of the design and fabrication of the major components being procured by APDA for the reactor components test is included. Radiation and temperature effects on fuel pins were investigated. Dry lubricants for bearing surfaces were tested. Test operations on reactor components are described. (For preceding period see PRDC-TR-14.) (W.D.M.)

4276 WAPD-PWR-PH-314
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
EVALUATION OF PWR POWER OSCILLATION TEST AND RECOMMENDATIONS CONCERNING FUTURE OPERATIONAL AND TEST PROCEDURES. B. H. Noordhoff. [June 1958]. 9p. $3.30(ph OTS); $2.40 (mf OTS).

The stability in the PWR core with respect to xenon oscillations was tested. An oscillation was deliberately established and followed through two cycles to determine if the plant response would exhibit convergent or divergent tendencies. A summary of test procedures and results is given, as well as an evaluation of the test and recommendations for future tests. (J.R.D.)

4277 WAPD-PWR-PMF-1070
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MAIN HYDRAULIC VALVE THERMAL SHOCK TEST. Test Evaluation DL-S-188 (T-612108). D. J. McDonald. Feb. 24, 1958. 19p. Contract [AT-11-1-GEN-14]. $4.80(ph OTS); $2.70(mf OTS).

The magnitude of the thermal shock to which the cylinders of the PWR coolant loop hydraulically-operated stop valves may be subjected was investigated. The test procedure is described along with a discussion of test data. It was concluded that the present design of the valve operating system is satisfactory. (J.R.D.)

4278 WAPD-PWR-TE-12
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR FISSION PRODUCT ACTIVITIES DURING THE PERFORMANCE OF DL-S-150, SECTION II. Test Evaluation. K. H. Vogel. July 9, 1958. 12p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

PWR fission product activity levels during a test from April 28 to May 3, 1958, are examined. The test was conducted as a part of a continuing program to obtain and evaluate radiochemistry data to be used in determining the source of fission products in the PWR coolant. The evaluation confirms previous findings that the source of fission products in the PWR coolant cannot be determined with certainty from the data taken thus far. The maximum amount of pertinent data will be obtained and analyzed during future testing and operation. (J.R.D.)

4279 WAPD-PWR-TE-13
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
FLOW DISTRIBUTION IN PWR CORE I. W. J. Gallagher. [Jan. 1958]. 4p. $1.80(ph OTS); $1.80 (mf OTS).

Flow distribution test results for PWR Core 1 were evaluated. The tests show results which confirm the design flow distribution for both 3 and 4 coolant loop full flow operation with main coolant pumps on fast speed. (W.L.H.)

4280 WAPD-PWR-TE-14

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DETERMINATION OF BASE LEVEL PRIMARY COOLANT FISSION PRODUCTS. Period IV. Test Evaluation DL-S-197 (T-641106). J. R. Coulter. Aug. 12, 1958. 6p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80 (mf OTS).

The test results of DL-S-197 establish the base level of fission products in PWR and confirm the analytical agreement between Bettis and Shippingport laboratories for the isotopes determined by both. The test results are not consistent with the level of fission product activities predicted by recoil from 1.5 ppm uranium contamination in the Zircaloy cladding. The reason for the inconsistency is being investigated. (auth)

4281 WAPD-PWR-TE-31

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ACTIVATION AND TRANSPORT OF LONG LIVED CORROSION PRODUCTS. Period IV. Test Evaluation DL-S-198 (T-641107). J. R. Coulter. Sept. 12, 1958. 7p. Contract [AT-11-1-GEN-14]. $1.80(ph OTS); $1.80(mf OTS).

Twenty liters of primary coolant were withdrawn from the influent of a purification ion exchanger. The samples were analyzed radiochemically for their major nuclides. Analysis of the insoluble corrosion products was also performed, and results are reported. (W.L.H.)

4282 WCAP-433

Westinghouse Electric Corp. [Atomic Power Dept.], Pittsburgh and Pennsylvania Power and Light Co. [Atomic Power Dept.], Pittsburgh.
PRELIMINARY SYSTEM ANALYSIS FOR THE PENNSYLVANIA ADVANCED REACTOR. T. Gogniat, S. J. Litrides, and M. Lukoff. [1956]. 20p. $3.30(ph OTS); $2.40(mf OTS).

Presented at the American Nuclear Society Winter Meeting, Dec. 10–12, 1956.

The method of attack for analyzing the stability and transient behavior of the PAR system is outlined, and a few of the results obtained from an analog computer are presented. This work must be viewed as preliminary until all the ramifications of the results are analyzed and various other effects are studied. (auth)

4283 YAEC-76

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
THE EFFECT OF LOCAL BOILING ON PRESSURE DROP AND FLOW DISTRIBUTION IN THE YANKEE REACTOR CORE. A. A. Bishop and R. Berringer. Aug. 29, 1958. 59p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $9.30(ph OTS); $3.60(mf OTS).

Where local boiling can occur in a semi-open heterogeneous reactor core consisting of parallel flow channels, differences in the terms comprising the total pressure drop in the local boiling regions and in parallel adjacent regions cause flow redistribution in the reactor. This report covers the study of the effect of local boiling on the friction factor and momentum components of the total pressure drop. The local-boiling to single-phase friction factor ratio has a maximum value of 1.42 when a linear relationship is assumed between the enthalpy of the coolant and the friction factor ratio. Analytical and graphical methods for determining the region of the core in local boiling are developed. For a cylindrical reactor core similar to the Yankee reactor core the maximum possible region of the core in which local boiling should occur would be an ellipsoid whose surface is the locus of points of local boiling. In the Yankee core the maximum possible volume in local boiling is 10.4 cubic feet and 14.4 cubic feet in the first and second parameter studies, respectively. These volumes are 4.5% and 5.5% of the total volume of the core. The nature and mechanism of local boiling is discussed and its relation to the single phase and true two-phase pressure drop is reviewed. Flow redistribution out of the hot channel due to local boiling is 17.6% and 23.8% for the first and second parameter studies, respectively. The first parameter study is for a 392 megawatt reactor and the second parameter study is for a 482 megawatt reactor. (auth)

4284 YAEC-83

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
A STUDY OF COMPLETE LOSS OF COOLANT FLOW IN THE YANKEE REACTOR. J. M. Gallagher, Jr. and D. Hunter. Nov. 1958. 112p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $18.30(ph OTS); $6.00(mf OTS).

The complete loss of primary coolant flow accident caused by the instantaneous loss of power to all four pumps was investigated. The principal objective was to determine the elapsed time from the initiation of the pump failure to the occurrence of bulk boiling at the outlet of the hot channel. Inherent was the determination of operating conditions necessary to eliminate the hot channel bulk boiling, these being added inertia in the primary coolant loop and scram delay time. Both the 392 Mw core and the 482 Mw core were included in the investigation. The results show that additional inertia is required as well as scram if bulk boiling is to be eliminated. As a result of several of the assumptions made, the investigation was limited to a study of that region of the reactor core where heat transfer takes place between the fuel and the coolant; primary system components such as the pressurizer and steam generator were excluded. The film heat transfer coefficient was varied as a function of flow rate but not as a function of coolant temperature, thus boiling phenomena were not included. Distributed parameter effects were incorporated in equations which describe the core thermal kinetics by an approximation technique. An approximation technique is also presented which allows the extrapolation of the results to the two pump failure case. Data for the investigation were obtained by the use of a general purpose d-c analog computer. (auth)

4285 YAEC-87

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE PERIOD APRIL 1, 1958 TO JUNE 30, 1958. I. H. Coen and R. W. Garbe. July 30, 1958. 134p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $2.75(OTS).

The principle progress during the second quarter of 1958 consisted of: accelerating the planning, scheduling, and coördination of the process-water and in-pile test loop irradiation programs; performing two-enrichment non-cycled core studies to determine the improvement in the radial hot channel factor over that which would apply for a uniform core; recalculating the contribution of control to the temperature coefficient using better thermal constant values and an improved method of obtaining control rod worths; performing a burnup analy-

sis of the reference control rod program to determine the effect of the program on the nuclear hot channel factor; comparing the decontaminating abilities of two promising ion-exchange resins using a synthetic corrosion product mixture; establishing a basic permanganate-citrate decontamination procedure which will provide a safe and efficient method of descaling the stainless steel primary coolant piping; investigating alternate fuel assembly designs to eliminate the possibility of excessive thermal bowing of the assembly which could result in impeding the movement of an adjacent control rod; determining flow and power output at any instant during a two-pump loss-of-coolant-flow accident; calculating the effect of local boiling on pressure drop and coolant flow distribution and the maximum possible volume of local boiling; performing visual flow studies and pressure drop measurements on a one-twelfth scale plastic reactor vessel model; investigating methods of improving the creep strength of silver–indium–cadmium control rod alloy by increasing grain size; initiating the preparation of a digital computer code to represent the transient behavior of the steam pressurizer; experimentally determining reactor parameters by measuring the reactor response to a variable by reactor period and control rod position change and by obtaining flux measurements using a variety of foil and wire detectors; modifying the in-pile test loop based on information obtained from visits to the loop fabricator and the Materials Testing Reactor; disassembling, identifying, and examining the second group of process-water specimens removed from the MTR; and performing post-irradiation measurements, collecting fission gases, and metallographically examining the ferrule brazes on two of the four specimens in the second group. Section-A of the Appendix contains the latest revised mechanical, thermal, and nuclear design data for the first core. Section-B, "Information Availability," reviews the accessibility to the Westinghouse Atomic Power Department and the Yankee Atomic Electric Company of documents and reports pertaining to nuclear power reactors. The quantities and types of reports and microfilms received by the Yankee Atomic Electric Company and Westinghouse Atomic Power Department during the second quarter of 1958 are also given in this section. Section-C contains abstracts of trip reports written as a result of visits made by Westinghouse APD and YAEC personnel during the second quarter of 1958 to nuclear testing facilities, vendors locations, and installations of AEC contractors. (For preceding period see YAEC-65.) (auth)

4286 YAEC-90

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

A STUDY OF DECONTAMINATION AGENTS FOR USE IN THE YANKEE REACTOR. R. M. Watkins. Nov. 1958. 44p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $7.80(ph OTS); $3.30(mf OTS).

A study of chemical decontamination agents for possible use in the Yankee Reactor is presented. The necessity for chemical decontamination is discussed along with the properties sought in an ideal cleaning solution. A survey of available decontamination information is presented together with a description of the experimental test program carried out at the Westinghouse Atomic Power Department in an effort to develop new and improved chemical methods for the removal of oxide scale and radioactive contamination from Yankee reactor primary coolant system components. On the basis of bench scale testing of various cleanup procedures, a method employing basic permanganate and citrate solutions was selected as offering the most promise for successful solution of Yankee primary loop contamination problems. Data are presented concerning the attack rates produced by these reagents on various reactor materials of construction, as is an evaluation of the possibility of caustic embrittlement of stainless steel resulting from the use of the basic permanganate solution. A discussion of future larger scale testing of the proposed decontaminants is also included. (auth)

4287 AEC-tr-3438

ENERGETICS OF NUCLEAR REACTORS. (Energeticheskie Yaderne Reaktory). A. K. Krasin. Translation of a publication of All-Union Society for Propagation of Political and Scientific Knowledge, Publishing House "Knowledge," Moscow, 1957. 42p. $0.75(OTS).

The principles of operation and the economics of atomic power stations are discussed. The physics of reactors and reactor materials is summarized, and types of reactors are discussed generally. (T.R.H.)

4288

QUALITIES AND DEFECTS OF URANIUM METAL AS NUCLEAR FUELS. Marcel Englander (Centre d'études nucléaires, Saclay, France). Inds. atomiques 2, No. 9-10, 85-97(1958). (In French)

A survey is presented of the metallurgical, physical, and chemical properties of natural uranium which present problems in its use as a nuclear fuel. The defects of natural uranium alloyed with various elements are also considered. The use of UO_2 as a fuel is briefly discussed. (J.S.R.)

4289

LEAK DETECTION IN NUCLEAR ENERGY HEAT EXCHANGERS. P. H. Crumley. Nuclear Energy Engr. 12, 448-9(1958) Dec.

A sensitive CO_2 leak detector for heat exchangers of gas-cooled nuclear reactors is described. The equipment operates in the following manner: Steam from the power plant is continuously sampled and any traces of CO_2 which may be carried by the steam are separated in the de-gasser and subsequently measured by an infra-red CO_2 analyser. A significant increase in the CO_2 content of the steam would indicate a leak between the CO_2 circuit and the steam circuit of the heat exchanger. (J.H.M.)

4290

POWER REACTOR TECHNOLOGY. Technical Progress Reviews, Vol. 2, No. 1. Dunedin, Fla., General Nuclear Engineering Corp., 1958. 40p. Available from U. S. Government Printing Office, Washington for $0.55.

The development and construction status of the different types of power reactors throughout the world is reviewed. An extensive tabulation giving reactor characteristics and including 72 bibliographic references is presented. Water-cooled and moderated reactors are discussed from the points of view of core materials, nuclear performance, and thermal performance. The discussion includes recent reports of Russian work on a pressurized water reactor. Designs and performance characteristics of gas-cooled reactors as developed and employed in Europe are compared with recent U. S. developmental effort in this area. The moderating properties of water and graphite are compared in a treatment of graphite-moderated water-cooled reactors. Geneva conference data on USSR reactors of this type are discussed. (T.R.H.)

4291
DEVELOPMENT AND DESIGN OF THE CADMIUM CONTROL STATIONS FOR A BOILING HEAVY WATER REACTOR. Helge Christensen and Bjarne Aarset. Bergen, A. S. John Griegs Boktrykkeri, 1958. 55p.

A description is given of the system for driving and controlling the cadmium rods for a 10 Mw boiling heavy water reactor, built in Halden, Norway. Different ways of positioning a control rod inside a pressurized system are discussed. Some special design features are described, and results of trial runs with a prototype control station are reviewed. (J.H.M.)

STABLE ISOTOPE SEPARATION

Refer also to abstract 4324.

4292
PREPARATION OF HIGH-POROUS SILVER MEMBRANES. F. I. Havlicek. "J. Stefan" Inst. Repts. (Ljubljana) 3, 135-40(1956). (Translated from Referat. Zhur. Khim. No. 6, 1958, Abstract No. 17702.)

A method for the preparation of highly porous silver membranes for the separation of isotopes is given. The membranes were prepared by leaching Zn out of a 0.2 mm foil of a Ag–Zn alloy. The leaching was done at 900 to 950°C with a CsCl–HCl solution. As the leaching causes the foils to become brittle, they are placed between copper plates with openings 5 to 10 mm in diameter. The total gap space in the membranes was 10^{-4} cm^2/cm^2. Some results obtained with uranium and hydrogen isotopes are given. (J.S.R.)

TECHNOLOGY

Raw Materials

4293 UCRL-5368
California. Univ., Livermore. Radiation Lab.
SOURCES OF HIGH-PURITY ELEMENTS. O. E. Snyder, R. E. Reichhold, E. M. Spenger, and G. J. Lundquist. Oct. 1958. 42p. Contract W-7405-eng-48. $1.25(OTS).

A catalog of suppliers of high-purity elements was collected by sending form letters to all known sources and collating their replies. (auth)

4294 WIN-101
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
INTERIM REPORT ON INVESTIGATIONS INTO THE PROBLEM OF RADIOACTIVE POLLUTION OF URANIUM MILL EFFLUENTS. M. A. DeSesa, comp. and ed. Dec. 15, 1958. 61p. Contract AT(49-6)-924. $10.80 (ph OTS); $3.90(mf OTS).

A review of the laboratory investigations to date into the problem of radioactive pollution of uranium mill effluents is presented. The scope of the problem is defined, preliminary survey data are outlined, and detailed investigations into means of alleviating the problem are presented. (auth)

4295 WIN-114
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
SURVEY AND PREVENTION TECHNIQUES FOR CONTROL OF RADIOACTIVITY HAZARDS AT THE MONTICELLO URANIUM MILL. R. G. Beverly, comp. and ed. Dec. 15, 1958. 68p. Contract AT(49-6)-924. $10.80(ph OTS); $3.90(mf OTS).

The techniques used in sampling, analyzing, and evaluating results for determining hazards from external radiation, airborne radioactive material, radioactive contaminants in mill effluents, and urinary uranium, as applied to the Monticello, Utah, uranium mill, are described. Corrective measures used by National Lead Company, Inc., at the Monticello Mill are described along with the results from later surveys which showed large reductions in the potential radiation hazards. Details are given of the methods used to determine personnel exposures to radioactive and silicosis-producing dusts, potential external radiation hazards and in assaying mill effluents for uranium and radium, assaying urine samples for uranium, as well as the standard operating procedures issued at Monticello to employees for preventing and/or controlling personnel exposures. (auth)

4296
URANIUM IN CANADA. R. A. Simpson (Dept. of Mines and Technical Surveys, Ottawa). Nuclear Energy Engr. 12, 425-8(1958) Dec.

Information is presented on uranium production in Canada. Discussions are included on the location of mines, extraction processes, types of mines, output, production costs, and marketing. (J.H.M.)

PATENTS

4297
PULSE SCALING SYSTEM. K. Kandiah (to U. S. Atomic Energy Commission). U. S. Patent 2,679,978. June 1, 1954.

Pulse scaling systems embodying multi-electrode gaseous-discharge tubes of the type having a plurality of stable discharge paths are described. The novelty of this particular system lies in the simplification of the stepping arrangement between successive tubes. In one form the invention provides a multistage scaler comprising a pulse generator, a first multi-electrode scaling tube of the type set forth coupled to said generator to receive transfer pulses therefrom and one or more succeeding multi-electrode scaling tubes each deriving its transfer pulses from preceding scaling tubes.

4298
ELECTRICAL CIRCUITS USING COLD-CATHODE TRIODE VALVES. F. S. Goulding (to U. S. Atomic Energy Commission). U. S. Patent 2,814,772. Nov. 26, 1957.

An electrical circuit which may be utilized as a pulse generator or voltage stabilizer is presented. The circuit employs a cold-cathode triode valve arranged to oscillate between its on and off stages by the use of selected resistance-capacitance time constant components in the plate and trigger grid circuits. The magnitude of the d-c voltage applied to the trigger grid circuit effectively controls the repetition rate of the output pulses. In the voltage stabilizer arrangement the d-c control voltage is a portion of the supply voltage and the rectified output voltage is substantially constant.

4299
ALLOY COATINGS AND METHOD OF APPLYING. L. D. Eubank and E. R. Boller (to U. S. Atomic Energy Commission). U. S. Patent 2,848,796. Aug. 26, 1958.

A method for providing uranium articles with a pro-

tective coating by a single dip coating process is presented. The uranium article is dipped into a molten zinc bath containing a small percentage of aluminum. The resultant product is a uranium article covered with a thin undercoat consisting of a uranium-aluminum alloy with a small amount of zinc, and an outer layer consisting of zinc and aluminum. The article may be used as is, or aluminum sheathing may then be bonded to the aluminum zinc outer layer.

4300

METAL COATED ARTICLES AND METHOD OF MAKING. L. D. Eubank (to U. S. Atomic Energy Commission). U. S. Patent 2,848,797. Aug. 26, 1958.

A method for manufacturing a solid metallic uranium body having an integral multiple layer protective coating, comprising an inner uranium-aluminum alloy firmly bonded to the metallic uranium is presented. A third layer of silver-zinc alloy is bonded to the zinc-aluminum layer and finally a fourth layer of lead-silver alloy is firmly bonded to the silver-zinc layer.

4301

METHOD OF JACKETING URANIUM BODIES. J. O. Maloney, E. B. Haines, and John B. Tepe (to U. S. Atomic Energy Commission). U. S. Patent 2,848,800. Aug. 26, 1958.

An improved process is presented for providing uranium slugs with thin walled aluminum jackets. Since aluminum has a slightly higher coefficient of thermal expansion than does uranium, both uranium slugs and aluminum cans are heated to an elevated temperature of about 180°C, and the slugs are inserted in the cans at that temperature. During the subsequent cooling of the assembly, the aluminum contracts more than does the uranium and a tight shrink fit is thus assured.

4302

METHOD AND MEANS FOR CLOSING TUBES BY SPINNING. E. E. Graves and R. H. Coonfare (to U. S. Atomic Energy Commission). U. S. Patent 2,848,804. Aug. 26, 1958.

An improved spinning tool is described for producing a fold-free closed end on an aluminum jacketing tube such as is commonly used to protect a uranium fuel element. The tool will fit the toolholder of a lathe in which the jacket is rotated. The tool has a number of working faces so that the hemispherical end-closure is formed, the folds and wrinkles are smoothed out, and the excess metal is trimmed off in one transverse cutting operation. This tool considerably speeds up the closure process, and eliminates the need for a weld seal.

4303

MEANS FOR DETERMINING CENTRIFUGE ALIGNMENT. W. Q. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,848,817. Aug. 26, 1958.

An apparatus is presented for remotely determining the alignment of a centrifuge. The centrifuge shaft is provided with a shoulder, upon which two followers ride, one for detecting radial movements, and one upon the shoulder face for determining the axial motion. The followers are attached to separate liquid filled bellows, and a tube connects each bellows to its respective indicating gage at a remote location. Vibrations produced by misalignment of the centrifuge shaft are transmitted to the bellows, and thence through the tubing to the indicator gage. This apparatus is particularly useful for operation in a hot cell where the materials handled are dangerous to the operating personnel.

4304

THERMALLY SHIELDED MOISTURE REMOVAL DEVICE. O. E. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,848,881. Aug. 26, 1958.

An apparatus is presented for removing moisture from the air within tanks by condensation upon a cartridge containing liquid air. An insulating shell made in two halves covers the cartridge within the evacuated system. The shell halves are hinged together and are operated by a system of levers from outside the tank with the motion translated through a sylphon bellows to cover and uncover the cartridge. When the condensation of moisture is in process, the insulative shell is moved away from the liquid air cartridge, and during that part of the process when there is no freezing out of moisture, the shell halves are closed on the cell so that the accumulated frost is not evaporated. This insulating shell greatly reduces the consumption of liquid air in this condensation process.

4305

CLOSURE DEVICE. S. M. Linzell and D. J. Dorcy (to U. S. Atomic Energy Commission). U. S. Patent 2,849,246. Aug. 26, 1958.

A quick opening type of stuffing box employing two banks of rotatable shoes, each of which has a camming action that forces a neoprene sealing surface against a pipe or rod where it passes through a wall is presented. A ring having a handle or wrench attached is placed eccentric to and between the two banks of shoes. Head bolts from the shoes fit into slots in this ring, which are so arranged that when the ring is rotated a quarter turn in one direction the shoes are thrust inwardly to cramp the neoprene about the pipe, making a tight seal. Moving the ring in the reverse direction moves the shoes outwardly and frees the pipe which then may be readily removed from the stuffing box. This device has particular application as a closure for the end of a coolant tube of a neutronic reactor.

4306

PROCESS OF SECURING PLUTONIUM IN NITRIC ACID SOLUTIONS IN ITS TRIVALENT OXIDATION STATE. J. R. Thomas (to U. S. Atomic Energy Commission). U. S. Patent 2,849,277. Aug. 26, 1958.

Various processes for the recovery of plutonium require that the plutonium be obtained and maintained in the reduced or trivalent state in solution. Ferrous ions are commonly used as the reducing agent for this purpose, but it is difficult to maintain the plutonium in a reduced state in nitric acid solutions due to the oxidizing effects of the acid. It has been found that the addition of a stabilizing or holding reductant to such solution prevents reoxidation of the plutonium. Sulfamate ions have been found to be ideally suitable as such a stabilizer even in the presence of nitric acid.

4307

CATALYTIC PROMOTION OF THE ADSORPTION OF VANADIUM ON AN ANIONIC EXCHANGE RESIN. R. H. Bailes and D. A. Ellis (to U. S. Atomic Energy Commission). U. S. Patent 2,849,279. Aug. 26, 1958.

An improvement in the process for the recovery of vanadium from acidic phosphatic solutions is presented. In this process the vanadium is first oxidized to the pentavalent state, and is then separated by contacting such solutions with an anion exchange resin whereby adsorption of the complexed pentavalent vanadium is effected. The improvement lies in the fact that adsorp-

tion of the vanadium complex by the anion exchange resin is promoted and improved by providing fluoride ions in solution to be contacted.

4308

METHOD OF SEPARATION. G. E. Boyd (to U. S. Atomic Energy Commission). U. S. Patent 2,849,282. Aug. 26, 1958.

A process is presented for separating uranium, plutonium, and fission products ions from uranyl nitrate solutions having a pH value between 1 and 3 obtained by dissolving neutron irradiated uranium. The method consists in passing such solutions through a bed of cation exchange resin, which may be a sulfonated phenol formaldehyde type. Following the adsorption step the resin is first treated with a solution of 0.2M to 0.3M sulfuric acid to desorb the uranium. Fission product ions are then desorbed by treating the resin in phosphoric acid and 1M in nitric acid. Lastly, the plutonium may be desorbed by treating the resin with a solution approximately 0.8M in phosphoric acid and 1M in nitric acid.

4309

SEPARATION OF URANYL NITRATE BY EXTRACTION. R. W. Stoughton and F. L. Steahly (to U. S. Atomic Energy Commission). U. S. Patent 2,849,283. Aug. 26, 1958.

A process is presented for obtaining U^{233} from solutions containing Pa^{233}. A carrier precipitate, such as MnO_2, is formed in such solutions and carries with it the Pa^{233} present. This precipitate is then dissolved in nitric acid and the solution is aged to allow decay of the Pa^{233} into U^{233}. After a sufficient length of time, the U^{233} bearing solution is made 2.5 to 4.5 Molar in manganese nitrate by addition thereof, and the solution is then treated with ether to obtain uranyl nitrate by solvent extraction techniques.

4310

METHOD OF SEPARATING URANIUM SUSPENSIONS. E. P. Wigner and W. A. McAdams (to U. S. Atomic Energy Commission). U. S. Patent 2,849,284. Aug. 26, 1958.

A process is presented for separating colloidally dispersed uranium oxides from the heavy water medium in which they are contained. The method consists in treating such dispersions with hydrogen peroxide, thereby converting the uranium to non-colloidal UO_4, and separating the UO_4 after its rapid settling.

4311

METHOD FOR PURIFYING URANIUM. J. W. Kennedy and E. G. Segre (to U. S. Atomic Energy Commission). U. S. Patent 2,849,285. Aug. 26, 1958.

A method is presented for obtaining a compound of uranium in an extremely pure state and in such a condition that it can be used in determinations of the isotopic composition of uranium. Uranium deposited in calutron receivers is removed therefrom by washing with cold nitric acid and the resulting solution, containing uranium and trace amounts of various impurities, such as Fe, Ag, Zn, Pb, and Ni, is then subjected to various analytical manipulations to obtain an impurity-free uranium containing solution. This solution is then evaporated on a platinum disk and the residue is ignited converting it to U_3O_8. The platinum disk having such a thin film of pure U_3O_8 is suitable for use with isotopic determination techniques.

4312

METHOD OF PROCESSING MONAZITE SAND. M. A. Welt and M. Smutz (to U. S. Atomic Energy Commission). U. S. Patent 2,849,286. Aug. 26, 1958.

A process is described for recovering thorium, uranium, and rare earth values from monazite sand. The monazite sand is first digested with sulfuric acid and the resulting "monazite sulfate" solution is adjusted to a pH of between 0.4 and 3.0, and oxalate anions are added causing precipitation of the thorium and the rare earths as the oxalates. The oxalate precipitate is separated from the uranium containing supernatant solution, and is dried and calcined to the oxides. The thorium and rare earth oxides are then dissolved in nitric acid and the solution is contacted with tributyl phosphate whereby an organic extract phase containing the cerium and thorium values is obtained, together with an aqueous raffinate containing the other rare earth values. The organic phase is then separated from the aqueous raffinate and the cerium and thorium are back extracted with an aqueous medium.

4313

METHOD AND FLUX COMPOSITION FOR TREATING URANIUM. F. Foote (to U. S. Atomic Energy Commission). U. S. Patent 2,849,307. Aug. 23, 1958.

A flux composition is described for use with molten uranium or uranium alloys. The flux consists of about 46 weight per cent calcium fluoride, 46 weight per cent magnesium fluoride and about 8 weight per cent of uranium tetrafluoride.

4314

FLUX COMPOSITION AND METHOD FOR TREATING URANIUM-CONTAINING METAL. F. Foote (to U. S. Atomic Energy Commission). U. S. Patent 2,849,308. Aug. 26, 1958.

A flux composition is presented for use with molten uranium and uranium alloys. It consists of about 60% calcium fluoride, 30% calcium chloride and 10% uranium tetrafluoride.

4315

PREPARATION OF METAL POWDER COMPACTS PRIOR TO PRESSING. H. Mansfield (to U. S. Atomic Energy Commission). U. S. Patent 2,849,313. Aug. 26, 1958.

A method of fabricating uranium by a powder metallurgical technique is described. It consists in introducing powdered uranium hydride into a receptacle shaped to coincide with the contour of the die cavity and heating the hydride so that it decomposes to uranium metal. The metal particles cohere in the shape of the receptacle and thereafter the preformed metal powder is pressed and sintered to obtain a dense compact.

4316

METAL COATING BATHS. J. W. Robinson (to U. S. Atomic Energy Commission). U. S. Patent 2,849,337. Aug. 26, 1958.

A method is presented for restoring the effectiveness of bronze coating baths used for hot dip coating of uranium. Such baths, containing a high proportion of copper, lose their ability to wet uranium surfaces after a period of use. The ability of such a bath to wet uranium can be restored by adding a small amount of metallic aluminum to the bath, and skimming the resultant hard alloy from the surface.

4317

FILTER TREATMENT. J. B. Sutton and J. V. P. Torrey (to U. S. Atomic Energy Commission). U. S. Patent 2,849,340. Aug. 26, 1958.

A process is described for reconditioning fused alumina filters which have become clogged by the accretion of bismuth phosphate in the filter pores. The method consists in contacting such filters with fuming sulfuric acid, and maintaining such contact for a substantial period of time.

4318

ELECTRODEPOSITION OF NICKEL ON URANIUM. A. G. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,849,348. Aug. 26, 1958.

A method is described for preparing uranium objects prior to nickel electroplating. The process consists in treating the surface of the uranium with molten ferric chloride hexahydrate, at a slightly elevated temperature. This treatment etches the metal surface providing a structure suitable for the application of adherent electrodeposits and at the same time plates the surface with a thin protective film of iron.

4319

CORROSION RESISTANT JACKETED METAL BODY. E. W. Brugmann (to U. S. Atomic Energy Commission). U. S. Patent 2,849,387. Aug. 26, 1958.

Reactor fuel elements of the elongated cylindrical type which are jacketed in a corrosion resistant material are described. Each fuel element is comprised of a plurality of jacketed cylinders of fissionable material in end to end abutting relationship, the jackets being welded together at their adjoining ends to retain the individual segments together and seal the interior of the jackets.

4320

CORROSION RESISTANT JACKETED METAL BODY. E. W. Brugmann (to U. S. Atomic Energy Commission). U. S. Patent 2,849,388. Aug. 26, 1958.

Metal jacketed metallic bodies of the type used as fuel elements for nuclear reactors are presented. The fuel element is comprised of a plurality of jacketed cylindrical bodies joined in end to end abutting relationship. The abutting ends of the internal fissionable bodies are provided with a mating screw and thread means for joining the two together. The jacket material is of a corrosion resistant metal and overlaps the abutting ends of the internal bodies, thereby effectively sealing these bodies from contact with external reactive gases and liquids.

4321

CORROSION RESISTANT JACKETED METAL BODY. E. W. Brugmann (to U. S. Atomic Energy Commission). U. S. Patent 2,849,389. Aug. 26, 1958.

Jacketed metal bodies of the type used as fuel elements for nuclear reactors, which contain an internal elongated body of fissionable material jacketed in a corrosion resistant metal are described. The ends of the internal bodies are provided with screw threads having a tapered outer end. The jacket material overlaps the ends and extends into the tapered section of the screw threaded opening. Screw caps with a mating tapered section are screwed into the ends of the body to compress the jacket material in the tapered sections to provide an effective seal against corrosive gases and liquids.

4322

WELDED JACKETED URANIUM BODY. D. H. Gurinsky (to U. S. Atomic Energy Commission). U. S. Patent 2,849,390. Aug. 26, 1958.

A fuel element is presented for a neutronic reactor and is comprised of a uranium body, a non-fissionable jacket surrounding said body, the jacket including a portion sealed by a weld, and an inclusion in said sealed jacket at said weld of a flux having a low neutron capture cross-section. The flux is provided by combining chlorine gas and hydrogen in the intense heat of the arc, in a "Heliarc" welding method, to form dry hydrochloric acid gas.

4323

SEPARATION OF RADIOACTIVE COLUMBIUM TRACER. L. E. Glendenin and H. Gest (to U. S. Atomic Energy Commission). U. S. Patent 2,849,467. Aug. 26, 1958.

A process is presented for the recovery of radioactive columbium from solutions containing such columbium together with radioactive tellurium. The columbium and tellurium values are separated from such solutions by means of an inorganic oxide carrier precipitate, such as MnO_2. This oxide carrier precipitate and its associated columbium and tellurium values are then dissolved in an aqueous acidic solution and non-radioactive tellurium, in an ionic form, is then introduced into such solution, for example in the form of H_2TeO_3. The tellurium present in the solution is then reduced to the elemental state and precipitates, and is then separated from the supernatant solution. A basic acetate precipitate is formed in the supernatant and carries the remaining columbium values therefrom. After separation, this basic ferric acetate precipitate is dissolved, and the ferric ions are removed by means of an organic solvent extraction process utilizing ether. The remaining solution contains carrier-free columbium as its only metal ion.

4324

ISOTOPE SEPARATORS. C. G. Bacon (to U. S. Atomic Energy Commission). U. S. Patent 2,849,616. Aug. 26, 1958.

An improvement is presented in the structure of an isotope separation apparatus and, in particular, is concerned with a magnetically operated shutter associated with a window which is provided for the purpose of enabling the operator to view the processes going on within the interior of the apparatus. The shutter is mounted to close under the force of gravity in the absence of any other force. By closing an electrical circuit to a coil mounted on the shutter the magnetic field of the isotope separating apparatus coacts with the magnetic field of the coil to force the shutter to the open position.

4325

NEUTRONIC REACTOR. L. A. Ohlinger, E. P. Wigner, A. M. Weinberg, and G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,850,447. Sept. 2, 1958.

This patent relates to neutronic reactors of the heterogeneous water cooled type, and in particular to a fuel element charging and discharging means therefor. In the embodiment illustrated the reactor contains horizontal, parallel coolant tubes in which the fuel elements are disposed. A loading cart containing a magazine for holding a plurality of fuel elements operates along the face of the reactor at the inlet ends of the coolant tubes. The loading cart is equipped with a ram device for feeding fuel elements from the magazine through the inlet ends of the coolant tubes. Operating along the face adjacent the discharge ends of the tubes there is provided another cart means adapted to receive irradiated fuel elements as they are forced out of the discharge ends of the coolant tubes by the incoming new fuel elements. This cart is equipped with a tank containing a coolant, such as water, into which the fuel elements fall, and a hydraulically operated plunger to hold the end of the fuel element being discharged. This invention provides

an apparatus whereby the fuel elements may be loaded into the reactor, irradiated therein, and unloaded from the reactor without stopping the flow of the coolant and without danger to the operating personnel.

4326

CALUTRON STRUCTURE. D. Price (to U. S. Atomic Energy Commission). U. S. Patent 2,850,634. Sept. 2, 1958.

An improved means is described for removably installing and supporting a collector pocket in a calutron. The salient feature of the invention is the support of the collector pocket by means of suspension bolts engaging the pocket at a point intermediate the top and bottom of the pocket, and having nuts so arranged that by turning upon the nuts the pocket is lifted up to and suspended in the desired predetermined position.

4327

REGULATOR FOR CALUTRON ION SOURCE. B. F. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,850,635. Sept. 2, 1958.

Improvements are described in electric discharge devices and circuits for a calutron and, more specifically, presents an arc discharge regulator circuit for the ion source of the calutron. In general, the source comprises a filament which bombards a cathode with electrons, a grid control electrode between the filament and the cathode, and an anode electrode. The control electrode has a DC potential which is varied in response to changes in the anode current flow by means of a saturable reactor installed in its power supply energizing line having the anode current flowing through its control winding. In this manner the bombardment current to the cathode may be decreased when the anode current increases beyond a predetermined level.

4328

ION PRODUCING MECHANISM. J. G. Backus (to U. S. Atomic Energy Commission). U. S. Patent 2,850,636. Sept. 2, 1958.

This patent relates to improvements in calutron devices and particularly describes a novel ion source. The unique feature of this source lies in the shaping of the ionizing electron stream to conform to the arc plasma boundary at the exit slit of the ionization chamber, thereby increasing the ion density produced at the plasma boundary. The particular structure consists of an electron source disposed at one end of an elongated ionization chamber and a collimating electrode positioned to trim the electron stream to a crescent shape before entering the ionization chamber.

4329

ION PRODUCING MECHANISM. K. R. MacKenzie (to U. S. Atomic Energy Commission). U. S. Patent 2,850,638. Sept. 2, 1958.

An ion source is described for use in a calutron and more particularly deals with an improved filament arrangement for a calutron. According to the invention, the ion source block has a gas ionizing passage open along two adjoining sides of the block. A filament is disposed in overlying relation to one of the passage openings and has a greater width than the passage width, so that both the filament and opening lengths are parallel and extend in a transverse relation to the magnetic field. The other passage opening is parallel to the length of the magnetic field. This arrangement is effective in assisting in the production of a stable, long-lived arc for the general improvement of calutron operation.

4330

CALUTRON RECEIVERS. F. H. Schmidt and K. F. Stone (to U. S. Atomic Energy Commission). U. S. Patent 2,850,639. Sept. 2, 1958.

This patent relates to improvements in calutron devices and, more specifically, describes a receiver for collecting the ion current after it is formed into a beam of non-homogeneous isotropic cross-section. The invention embodies a calutron receiver having an ion receiving pocket for separately collecting and retaining ions traveling in a selected portion of the ion beam and an electrode for intercepting ions traveling in another selected portion of the ion beam. The electrode is disposed so as to fix the limit of one side of the portion of the ion beam admitted into the ion receiving pocket.

4331

PREPARATION OF HALIDES OF PLUTONIUM. C. S. Garner and I. B. Johns (to U. S. Atomic Energy Commission). U. S. Patent 2,851,332. Sept. 9, 1958.

A dry chemical method is described for preparing plutonium halides, which consists in contacting plutonyl nitrate with dry gaseous HCl or HF at an elevated temperature. The addition to the reaction gas of a small quantity of an oxidizing gas or a reducing gas will cause formation of the tetra- or tri-halide of plutonium as desired.

4332

PROCESS OF SEPARATING PLUTONIUM FROM URANIUM. H. S. Brown and O. F. Hill (to U. S. Atomic Energy Commission). U. S. Patent 2,851,333. Sept. 9, 1958.

A process is presented for recovering plutonium values from aqueous solutions. It comprises forming a uranous hydroxide precipitate in such a plutonium bearing solution, at a pH of at least 5. The plutonium values are precipitated with and carried by the uranium hydroxide. The carrier precipitate is then redissolved in acid solution and the pH is adjusted to about 2.5, causing precipitation of the uranous hydroxide but leaving the still soluble plutonium values in solution.

4333

METHOD FOR TESTING COATINGS. I. B. Johns and A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent 2,851,338. Sept. 9, 1958.

A method is described for detecting pin hole imperfections in coatings on uranium-metal objects. Such coated objects are contacted with a heated atmosphere of gaseous hydrogen and imperfections present in the coatings will allow the uranium to react with the hydrogen to form uranium hydride. Since uranium hydride is less dense than uranium metal it will swell, causing enlargement of the coating defect and rendering it visible.

4334

NEUTRONIC REACTOR FUEL ELEMENT AND CORE SYSTEM. W. T. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,851,409. Sept. 9, 1958.

This patent relates to neutronic reactors and in particular to an improved fuel element and a novel reactor core system for facilitating removal of contaminating fission products, as they are formed, from association with the fissionable fuel, so as to mitigate the interferent effects of such fission products during reactor operation. The fuel elements are comprised of tubular members impervious to fluid and containing on their interior surfaces a thin layer of fissionable material providing a central void. The core structure is comprised

of a plurality of the tubular fuel elements arranged in parallel and a closed manifold connected to their ends. In the reactor the core structure is dispersed in a water moderator and coolant within a pressure vessel, and a means connected to said manifold is provided for withdrawing and disposing of mobile fission product contamination from the interior of the fuel tubes and manifold.

4335

NEUTRONIC REACTOR CONSTRUCTION. H. C. Vernon and J. J. Goett (to U. S. Atomic Energy Commission). U. S. Patent 2,851,410. Sept. 9, 1958.

A cover device is described for the fuel element receiving tube of a neutronic reactor of the heterogeneous, water cooled type wherein said tubes are arranged in a moderator with their longitudinal axes vertical. The cover is provided with means to support a rod-type fuel element from the bottom thereof and means to lock the cover in place, the latter being adapted for remote operation. This cover device is easily removable and seals the opening in the upper end of the fuel tube against leakage of coolant.

4336

METHOD OF PURIFYING CATALYSTS. G. G. Joris (to U. S. Atomic Energy Commission). U. S. Patent 2,851,427. Sept. 9, 1958.

It has been found that the presence of chlorine as an impurity adversely affects the performance of finely divided platinum catalysts such as are used in the isotopic exchange process for the production of heavy water. This chlorine impurity may be removed from these catalysts by treating the catalyst at an elevated temperature with dry hydrogen and then with wet hydrogen, having a hydrogen-water vapor volume of about 8 : 1. This alternate treatment by dry hydrogen and wet hydrogen is continued until the chlorine is largely removed from the catalyst.

4337

CALUTRON RECEIVERS. E. J. Lofgren (to U. S. Atomic Energy Commission). U. S. Patent 2,851,607. Sept. 9, 1958.

Improvements are described in isotope separation devices of the calutron type and, in particular, deals with a novel calutron receiver which passes the optimum portions of the ion beam to a collecting chamber. In its broad aspects the receiver provides means for passing a delimited portion of the beam and an elongated collecting pocket disposed to receive ions passed by the beam delimiting means. The collecting pocket is transversely partitioned into a plurality of ion receiving compartments respectively defined by a corresponding plurality of separately removable liner elements.

4338

ION PRODUCING MECHANISM (ARC EXTERNAL TO BLOCK). W. H. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,851,609. Sept. 9, 1958.

This patent pertains to an ion producing mechanism employed in a calutron which has the decided advantages of an increased amount of ionization effectuated by the arc, and a substantially uniform arc in point of time, in arc location and along the arc length. The unique features of the disclosed ion source lie in the specific structural arrangement of the source block, gas ionizing passage, filament shield and filament whereby the arc is established both within the ionizing passage and immediately outside the exit of the ionizing passage at the block face.

4339

PLURAL METALLIC COATINGS ON URANIUM AND METHOD OF APPLYING SAME. A. G. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,851,766. Sept. 16, 1958.

A method is described of applying protective coatings to uranium articles. It consists in applying chromium plating to such uranium articles by electrolysis in a chromic acid bath and subsequently applying, to this chromium surface, molten aluminum metal or aluminum containing alloy. This aluminum containing alloy (for example one of aluminum and silicon) may then be used as a bonding alloy between the chromized surface and an aluminum can.

4340

FLUID SELECTING APPARATUS. W. J. Stinson (to U. S. Atomic Energy Commission). U. S. Patent 2,852,041. Sept. 16, 1958.

A valve designed to selectively sample fluids from a number of sources is described. The valve comprises a rotatable operating lever connected through a bellows seal to a rotatable assembly containing a needle valve, bearings, and a rotational lock. The needle valve is connected through a flexible tube to the sample fluid outlet. By rotating the lever the needle valve is placed over one of several fluid sources and locked in position so that the fluid is transferred through the flexible tubing and outlet to a remote sampling system. The fluids from the nonselected sources are exhausted to a waste line. This valve constitutes a simple, dependable means of selecting a sample from one of several sources.

4341

SLUG HANDLING DEVICES. J. R. Gentry (to U. S. Atomic Energy Commission). U. S. Patent 2,852,301. Sept. 16, 1958.

A device is described for handling fuel elements of a neutronic reactor. The device consists of two concentric telescoped containers that may fit about the fuel element. A number of ratchet members, equally spaced about the entrance to the containers, are pivoted on the inner container and spring biased to the outer container so that they are forced to bear against and hold the fuel element, the weight of which tends to force the ratchets tighter against the fuel element. The ratchets are released from their hold by raising the inner container relative to the outer member. This device reduces the radiation hazard to the personnel handling the fuel elements.

4342

THRUST BEARING. P. R. Heller (to U. S. Atomic Energy Commission). U. S. Patent 2,852,319. Sept. 16, 1958.

A thrust bearing suitable for use with a rotor or blower that is to rotate about a vertical axis is described. A centrifugal jack is provided so that the device may operate on one bearing at starting and lower speeds, and transfer the load to another bearing at higher speeds. A low viscosity fluid is used to lubricate the higher speed operation bearing, in connection with broad bearing surfaces, the ability to withstand great loads, and a relatively high friction loss, as contrasted to the lower speed operation bearing which will withstand only light thrust loads but is sufficiently friction-free to avoid bearing seizure during slow speed or startup operation. An axially aligned shaft pin provides the bearing surface for low rotational speeds, but at higher speed, weights operating against spring tension

withdraw the shaft pin into the bearing proper and the rotor shaft comes in contact with the large bearing surfaces.

4343

PEROXIDE PROCESS FOR SEPARATION OF RADIOACTIVE MATERIALS. G. T. Seaborg and I. Perlman (to U. S. Atomic Energy Commission). U. S. Patent 2,852,336. Sept. 16, 1958.

A method is described of separating plutonium, in the reduced state, from hexavalent uranium. It consists in treating an aqueous solution containing such uranium and plutonium ions with sulfate ions in order to form a soluble uranium sulfate complex and then treating the solution with a soluble thorium compound and a soluble peroxide compound in order to form a thorium peroxide carrier precipitate which carries down with it the plutonium peroxide present. During this treatment the pH of the solution must be maintained between 2 and 3.

4344

PROCESSES OF CHLORINATION OF URANIUM OXIDES. S. Rosenfeld (to U. S. Atomic Energy Commission). U. S. Patent 2,852,337. Sept. 16, 1958.

An improvement is described in the process for making UCl_4 from uranium oxide and carbon tetrachloride. In that process, oxides of uranium are contacted with carbon tetrachloride vapor at an elevated temperature. It has been found that the reaction product and yield are improved if the uranium oxide charge is disposed in flat trays in the reaction zone, to a depth of not more than $\frac{1}{2}$ centimeter.

4345

SEPARATION OF PLUTONIUM FROM ELEMENTS HAVING AN ATOMIC NUMBER NOT LESS THAN 92. F. T. Fitch and D. S. Russell (to U. S. Atomic Energy Commission). U. S. Patent 2,852,338. Sept. 16, 1958.

A method is described for separating plutonium from other elements having atomic numbers not less than 92. It has been proposed in the past to so separate plutonium by solvent extraction into an organic solvent using triglycoldichloride as the organic solvent. The improvement lies in the discovery that triglycoldichloride performs far more efficiently as an extractant, when certain second organic compounds are added to it. Mentioned as satisfactory additive compounds are benzaldehyde, saturated aliphatic aldehydes containing at least two carbon atoms, and certain polyhydric phenols.

4346

APPARATUS FOR LIQUID PHASE EXTRACTION. T. E. Hicks, H. R. Lehman, and B. Rubin (to U. S. Atomic Energy Commission). U. S. Patent 2,852,349. Sept. 16, 1958.

A pulse extraction device adapted for inverted density operation is described. It comprises a tubular column having upper and lower enlarged terminal portions, and a constricted central section containing fluid dispersal packing. Pulsing means are coupled to the upper portion of the column. The inlet for the less dense phase is located above the inlet for the denser phase and both are positioned so that liquids enter the constricted packing-filled central section. The apparatus also includes an interfacing level control, and means for sensing the level of the interface actuate apparatus for controlling the rate of flow of input or discharge. The outlet for the less dense phase is located in the upper packing free portion of the column and that of the denser phase in the lower portion.

4347

MELTING AND PURIFICATION OF URANIUM. F. H. Spedding and C. F. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,852,364. Sept. 16, 1958.

A process is described for treating uranium ingots having inner metal portions and an outer oxide skin. The method consists in partially supporting such an ingot on the surface of a grid or pierced plate. A sufficient weight of uranium is provided so that when the mass becomes molten, the oxide skin bursts at the unsupported portions of its bottom surface, allowing molten uranium to flow through the burst skin and into a container provided below.

4348

PROCESS OF DECONTAMINATING MATERIAL CONTAMINATED WITH RADIOACTIVITY. D. C. Overholt, M. D. Peterson, and M. F. Acken (to U. S. Atomic Energy Commission). U. S. Patent 2,852,419. Sept. 16, 1958.

A process is described for decontaminating metallic objects, such as stainless steel equipment, which consists in contacting such objects with nitric acid in a concentration of 35 to 60% to remove the major portion of the contamination; and thereafter contacting the partially decontaminated object with a second solution containing up to 20% of alkali metal hydroxide and up to 20% sodium tartrate to remove the remaining radioactive contaminants.

4349

NEUTRONIC REACTOR. E. J. Wade (to U. S. Atomic Energy Commission). U. S. Patent 2,852,456. Sept. 16, 1958.

This patent relates to a reflector means for a neutronic reactor. A reflector comprised of a plurality of vertically movable beryllium control members is provided surrounding the sides of the reactor core. An absorber of fast neutrons comprised of natural uranium surrounds the reflector. An absorber of slow neutrons surrounds the absorber of fast neutrons and is formed of a plurality of beryllium blocks having natural uranium members distributed therethrough. In addition, a movable body is positioned directly below the core and is comprised of a beryllium reflector and an absorbing member attached to the bottom thereof, the absorbing member containing a substance selected from the group consisting of natural uranium and Th^{232}.

4350

NUCLEAR REACTORS. E. Long and J. W. Ashby (to U. S. Atomic Energy Commission). U. S. Patent 2,852,457. Sept. 16, 1958.

A graphite moderator structure is presented for a nuclear reactor comprised of an assembly of similarly orientated prismatic graphite blocks arranged on spaced longitudinal axes lying in common planes wherein the planes of the walls of the blocks are positioned so as to be twisted relative to the planes of said axes so that the unimpeded direct paths in direction wholly across the walls of the blocks are limited to the width of the blocks plus spacing between the blocks.

4351

APPARATUS FOR CONTROLLING NEUTRONIC REACTORS. J. R. Dietrich and J. M. Harrer (to U. S. Atomic Energy Commission). U. S. Patent 2,852,458. Sept. 16, 1958.

A device is described for rapidly controlling the reactivity of an active portion of a reactor. The invention consists of coaxially disposed members each having

circumferential sections of material having different neutron absorbing characteristics and means for moving the members rotatably and translatably relative to each other within the active portion to vary the neutron flux therein. The angular and translational movements of any member change the neutron flux shadowing effect of that member upon the other member.

4352

APPARATUS FOR DETECTING AND LOCATING PRESENCE OF FLUIDS. R. R. Williamson (to U. S. Atomic Energy Commission). U. S. Patent 2,852,459. Sept. 16, 1958.

A system is described for detecting water leaks in water-cooled neutronic reactors by utilizing an electrical hygrometer having a resistance element variable with the moisture content. The graphite blocks, forming the moderator in many types of reactors, contain ducts in which helium gas is circulated. When a leak occurs in a coolant tube, the water will seep through the graphite until it oozes into one of the helium ducts, where it will be swept along with the helium into a system of pipes that connect each of the helium ducts. By inserting an electric hygrometer in each of these pipes and connecting it to an alarm system, the moisture content of the helium will cause a change in the electrical resistance of the hygrometer which will initiate a signal alarm indicating the presence and position of the leaky water tube in the reactor.

4353

FUEL-BREEDER FUEL ELEMENT FOR NUCLEAR REACTOR. W. E. Abbott and R. Balent (to U. S. Atomic Energy Commission). U. S. Patent 2,852,460. Sept. 16, 1958.

A fuel element design to facilitate breeding reactor fuel is described. The fuel element is comprised of a container, a central core of fertile material in the container, a first bonding material surrounding the core, a sheet of fissionable material immediately surrounding the first bonding material, and a second bonding material surrounding the fissionable material and being in contact with said container.

4354

NEUTRONIC REACTOR. E. Fermi, W. H. Zinn, and H. L. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,852,461. Sept. 16, 1958.

Means are presented for increasing the reproduction ratio of a graphite-moderated neutronic reactor by diminishing the neutron loss due to absorption or capture by gaseous impurities within the reactor. This means is comprised of a fluid-tight casing or envelope completely enclosing the reactor and provided with a valve through which the casing, and thereby the reactor, may be evacuated of atmospheric air.

4355

ION SOURCE FOR CALUTRONS. J. R. Tolmie (to U. S. Atomic Energy Commission). U. S. Patent 2,852,685. Sept. 16, 1958.

An improvement is presented in ion sources of the type employed in calutron devices. The described ion source has for its inventive contribution the incorporation of a plate-like cathode having the general configuration of a polygon including a given number of apices. When a polyphase source of current has a phase connected to each of the apices, the cathode is heated and rendered electron emissive. This particular cathode configuration is of sturdy construction and provides uniform emission over a considerable area.

4356

CALUTRON RECEIVERS. K. R. MacKenzie (to U. S. Atomic Energy Commission). U. S. Patent 2,852,686. Sept. 16, 1958.

A novel calutron receiver is described for collecting the constituent material of two closely adjacent selected portions of an ion beam in separate compartments. The receiver is so constructed that ion scatter and intermixing of the closely adjacent beam portions do not occur when the ions strike the receiver structure, and the beam is sharply separated into the two compartments. In essence, these desirable results are achieved by inclining the adjoining wall of one compartment with respect to the approaching ions to reduce possible rebounding of ions from the compartment into the adjacent compartment.

4357

ISOTOPE SEPARATING APPARATUS. M. K. Kudravetz and H. B. Greene (to U. S. Atomic Energy Commission). U. S. Patent 2,852,687. Sept. 16, 1958.

This patent relates to control systems for a calutron and, in particular, describes an electro-mechanical system for interrupting the collection of charged particles when the ratio between the two isotopes being received deviates from a predetermined value. One embodiment of the invention includes means responsive to the ratio between two isotopes being received for opening a normally closed shutter over the receiver entrance when the isotope ratio is the desired value. In another form of the invention the collection operation is interrupted by changing the beam accelerating voltage to deflect the ion beam away from the receiver.

4358

CALUTRONS. W. M. Pierson (to U. S. Atomic Energy Commission). U. S. Patent 2,852,688. Sept. 16, 1958.

A vacuum tank is described for a calutron and the mounting means for the tank whereby the tank may be conveniently positioned in the proper place between the poles of the magnet and there readily adjusted in height. A plurality of grooved guide wheels are mounted on adjustable levers attached to one side of the tank, along with a plurality of plain rollers mounted on adjustable levers attached to the same side of the tank on the opposite edge. The grooved guide wheels and rollers cooperate with a guide track and runway, respectively, for movement of the tank into and out of the magnet gap, while the adjustable levers permit the accurate positioning of the tank between the magnet pole pieces.

4359

ION PRODUCING MECHANISM. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,852,689. Sept. 16, 1958.

Improvements are presented in calutron devices and, more specifically, deals with an improved mounting arrangement for the ion source of the calutron. An important feature of the invention resides in a plurality of insulators so mounted as to be accessible from the exterior of the calutron tank and supporting at their inner ends the ion source. These insulators are arranged in mutually parallel relation and also parallel to the flux of the magnetic field, whereby the strain of the supporting elements is reduced to a minimum. In addition, the support assembly is secured to a removable wall portion of the tank to facilitate withdrawal and examination of the ion producing mechanism.

4360

CALUTRONS. E. O. Lawrence (to U. S. Atomic Energy

Commission). U. S. Patent 2,852,690. Sept. 16, 1958.

This patent relates to calutron devices and has for its object the arrangement of several independent ion separating mechanisms, i.e., ion source and ion receiver, within a single vacuum tank to economize on space and reduce the duplication of magnetic structure. In each of the two described embodiments the ion separating mechanisms are removably supported within the tank. In addition, the magnetic field is produced in the tank by coaxial coils supported outside the tank and magnetic structure is arranged to confine and provide a uniform field within the tank.

4361

VOLTAGE-CONTROLLED TRANSISTOR OSCILLATOR. P. F. Scheele (to U. S. Atomic Energy Commission). U. S. Patent 2,852,746. Sept. 16, 1958.

This patent relates to transistor oscillators and in particular to those transistor oscillators whose frequencies vary according to controlling voltages. A principal feature of the disclosed transistor oscillator circuit resides in the temperature compensation of the frequency modulating stage by the use of a resistor-thermistor network. The resistor-thermistor network components are selected to have the network resistance, which is in series with the modulator transistor emitter circuit, vary with temperature to compensate for variation in the parameters of the transistor due to temperature change.

4362

CASTING APPARATUS. C. F. Gray and R. H. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,852,823. Sept. 23, 1958.

An apparatus is described for casting small quantities of uranium. It consists of a crucible having a hole in the bottom with a mold positioned below. A vertical rod passes through the hole in the crucible and has at its upper end a piercing head adapted to break the oxide skin encasing a molten uranium body. An air tight cylinder surrounds the crucible and mold, and is arranged to be evacuated.

4363

OSCILLATORY PUMP. N. Underwood (to U. S. Atomic Energy Commission). U. S. Patent 2,853,228. Sept. 23, 1958.

This patent relates to a pump suitable for pumping highly corrosive gases wherein no lubricant is needed in the pumping chamber thus eliminating possible contamination sources. The chamber contains a gas inlet and outlet in each side, with a paddle like piston suspended by a sylphon seal between these ports. An external arrangement causes the paddle to oscillate rapidly between the ports, alternately compressing and exhausting the gas trapped on each side of the paddle. Since the paddle does not touch the chamber sides at any point, no lubricant is required. This pump is useful for pumping large quantities of uranium hexafluorine.

4364

SCANNER FOR EXPOSING AND ANALYZING MULTI-CHANNEL FILM. D. J. Zaffarano, John Weber, Jr., and W. A. Rhinehart (to U. S. Atomic Energy Commission). U. S. Patent 2,853,237. Sept. 23, 1958.

A machine capable of analyzing a photographic film used to record pulse amplitude distribution presented on an oscilloscope is described. The film has longitudinal strips or channels representing a particular pulse amplitude range and each strip must be individually scanned to count the number of exposure dots or pulses. In the present machine a film channel is scanned and the dots are converted to electrical pulses which are counted in a mechanical register. After the first channel is scanned, the scanning head is automatically moved laterally across the film to scan the next channel and the film analysis is continued until each channel has been scanned. Another important feature of the invention is the mechanical arrangement of the scanning head to facilitate the removal of the film positioned in the scanning head.

4365

SURFACE TREATMENT OF URANIUM. O. Flint (to U. S. Atomic Energy Commission). U. S. Patent 2,853,441. Sept. 23, 1958.

A method is described for pretreating the surface of uranium metal bodies prior to electroplating or dip coating. A bright lustrous surface is produced on uranium metal having a black oxide coating, by first causing it to undergo anodic electrolytic treatment in aqueous sodium carbonate, in order to remove the black oxide coating. The metal is then given another anodic electrolytic treatment in 10% aqueous citric acid solution in order to produce the bright finish desired.

4366

FUEL-BREEDER ELEMENT FOR A NUCLEAR REACTOR. W. E. Abbott and R. Balent (to U. S. Atomic Energy Commission). U. S. Patent 2,853,446. Sept. 23, 1958.

A nuclear reactor fuel element designed for the breeding of reactor fuel material is described. The fuel element is comprised of a container of low thermal neutron absorption cross-section, a central core of solid fertile material, and a non-aqueous fluid fuel composition disposed between the core and the walls of the container.

4367

CALUTRON STRUCTURE. J. L. Roush (to U. S. Atomic Energy Commission). U. S. Patent 2,853,616. Sept. 23, 1958.

This patent describes an improved calutron collector structure wherein the upstanding blade assembly located in the collector pocket, commonly termed a footscraper, is of novel design. According to the invention, the footscraper may be removed from the collector pocket as a unit and the assembly may then be easily disassembled to facilitate chemical processing of the isotope material from the individual blade walls.

4368

X-RAY PULSE GENERATOR. Q. A. Kerns (to U. S. Atomic Energy Commission). U. S. Patent 2,853,623. Sept. 23, 1958.

This patent relates to an X-ray generator having short time duration per pulse, and particularly describes a simple, portable and inexpensive X-ray source utilizing a commercial type television receiving tube and a small auto-transformer. The tube has a voltage substantially greater than the rate operating value of the tube applied between anode and ground from the full winding of the auto-transformer. In operation a pulse source supplies a voltage to the auto-transformer and the tube is caused to operate at the maximum of the voltage curve by applying the same pulse with negative polarity to the positive biased cathode through a delay line. The X-ray output pulse is cut off abruptly by use of a shorted delay line at the cathode of the tube to shorten the trigger pulse.

4369

RADIATION SHIELDING DEVICE. E. P. Wigner and G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,853,624. Sept. 23, 1958.

A radiation shield that is suitable for the protection of personnel from both gamma rays and neutrons is described. The shield is comprised of a hollow wall and an aggregate consisting of iron and water in approximately equal amounts by volume substantially filling the wall. A means is provided to circulate the water through the wall to cool the shield when in use.

4370

DISCHARGE DEVICE FOR RADIOACTIVE MATERIAL. L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,853,625. Sept. 23, 1958.

A device is described for unloading bodies of fissionable material from a neutronic reactor. It is comprised essentially of a wheeled flat car having a receptacle therein containing a liquid coolant for receiving and cooling the fuel elements as they are discharged from the reactor, and a reciprocating plunger for supporting the fuel element during discharge thereof prior to its being dropped into the coolant. The flat car is adapted to travel along the face of the reactor adjacent the discharge ends of the coolant tubes.

4371

MAGNETS. H. B. Hofacker (to U. S. Atomic Energy Commission). U. S. Patent 2,853,657. Sept. 23, 1958.

This patent relates to magnets used in a calutron and more particularly to means for clamping an assembly of magnet coils and coil spacers into tightly assembled relation in a fluid-tight vessel. The magnet comprises windings made up of an assembly of alternate pan-cake type coils and spacers disposed in a fluid-tight vessel. At one end of the tank a plurality of clamping strips are held firmly against the assembly by adjustable bolts extending through the adjacent wall. The foregoing arrangement permits taking up any looseness which may develop in the assembly of coils and spacers.

4372

ELECTROSTATIC MEMORY SYSTEM. Jeffrey C. Chu (to U. S. Atomic Energy Commission). U. S. Patent 2,853,695. Sept. 23, 1958.

An improved electrostatic memory system is described for a digital computer wherein a plurality of storage tubes are adapted to operate in either of two possible modes. According to the present invention, duplicate storage tubes are provided for each denominational order of the several binary digits. A single discriminator system is provided between corresponding duplicate tubes to determine the character of the information stored in each. If either tube produces the selected type signal, corresponding to binary "1" in the preferred embodiment, a "1" is regenerated in both tubes. In one mode of operation each bit of information is stored in two corresponding tubes, while in the other mode of operation each bit is stored in only one tube in the conventional manner.

4373

COLD TRAPS. W. I. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,853,859. Sept. 30, 1958.

A cold trap is presented for removing a condensable component from a gas mixture by cooling. It consists of a shell, the exterior surface of which is chilled by a refrigerant, and conductive fins welded inside the shell to condense the gas, and distribute the condensate evenly throughout the length of the trap, so that the trap may function until it becomes completely filled with the condensed solid. The contents may then be removed as either a gas or as a liquid by heating the trap. This device has particular use as a means for removing uranium hexafluoride from the gaseous diffusion separation process during equipment breakdown and repair periods.

4374

ELECTROLYTIC REDUCTION OF NITRIC ACID SOLUTIONS. H. W. Alter and D. L. Barney (to U. S. Atomic Energy Commission). U. S. Patent 2,854,315. Sept. 30, 1958.

A process is presented for the treatment of radioactive waste nitric acid solutions. The nitric acid solution is neutralized with an alkali metal hydroxide in an amount sufficient to precipitate insoluble hydroxides, and after separation of the precipitate the solution is electrolyzed to convert the alkali nitrate formed, to alkali hydroxide, gaseous ammonia and oxygen. The solution is then reusable after reducing the volume by evaporating the water and dissolved ammonia.

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